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COLD LAKE - BEAVER RIVER WATER MANAGEMENT STUDY

VOLUME 6
RECREATION

Appendix J . . . Water Based Recreation

Water Resources

Alberta

ENVIRONMENT
Planning Division

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COLD LAKE — BEAVER RIVER
WATER MANAGEMENT STUDY

VOLUME 6
RECREATION

PREPARED BY
PLANNING DIVISION
ALBERTA ENVIRONMENT
December 1983

Submitted to: Hon. F. Bradley
Minister of Environment

APPENDIX J

WATER BASED RECREATION

A Report Prepared By
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May 19, 1983
File: 45-82305-A01

Mr. Ron Hicks, P.Eng.
Athabasca River Basin Planner
Planning Division
Alberta Environment
9th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

Dear Mr. Hicks

Re: Final Report - Cold Lake - Beaver River
Regional Water Resources Study

We are pleased to present the camera-ready originals of the Cold Lake - Beaver River Regional Water Resources Study report. The oversized drawings have been packaged separately for your convenience.

Our assessment of the implications of water management scenarios on recreational shoreline opportunities should prove useful in the Department's evaluation of a preferred scenario. The impact assessment tables for each lake and the summary assessment table for all the lakes should allow for easy reference of our conclusions.

It has been a great pleasure working with you and other members of your Department. We look forward to the opportunity of working with the Department in the near future.

Yours very truly

MARSHALL MACKLIN MONAGHAN WESTERN LIMITED

D. Lyall Adams
Manager, Planning Department
Associate

DLA/RAGW:ef

encl.

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B. RECREATION CAPABILITY ASSESSMENT METHODOLOGY

C. RIVER RECREATION ASSESSMENTS

(Note: The assessment of the river recreation resources which would result from the recommended acceptable lake level fluctations have not been included at this time. These assessments will be appended following the computer modelling of the river and lake systems by Alberta Environment which will determine the change in streamflows.)

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1. BEAVER RIVER BASIN WATER-BASED RECREATION

1.1 Introduction

The Cold Lake - Beaver River area is well recognized for its outstanding water-based recreation resources. For the past twenty years, the shorelines of many lakes in the region have been developed for provincial parks, camping and day use areas, providing opportunities for both Albertans as well as tourists, predominantely from Saskatchewan. In addition to developments by the public sector, significant private investment has occurred in the area with the establishment of cottage subdivisions, motels, food concessions and marinas. The increasing importance of water-based recreation in Alberta, dramatic increase in exposure of the Cold Lake area on both provincial and national scales and the increase in the local population have all contributed to a significant increase in the amount of water-based recreation activities occurring on the lakes and rivers in the study area.

The impending development of the Cold Lake heavy oils has necessitated the establishment of a framework plan for the long-term management of the surface and groundwater resources in the affected area. To this end, Alberta Environment has initiated the Cold Lake - Beaver River regional water resources study. A ten component planning programme has been developed in which factors including management issues, water supply, water use, administrative framework, public participation, social impact and modelling will be studied and evaluated, leading to the formulation of a comprehensive water management plan.

Several private consulting firms have been retained by Alberta Environment to complete certain elements of the study programme with Marshall Macklin Monaghan Western Limited awarded the contract to carry out an examination of water-based recreation. This recreation study of selected lakes and rivers was undertaken as part of the regional water resources study and has been prepared in accordance with the terms of reference.

1.2 Purpose and Scope

The purpose of this study is to determine the water demand associated with water-based recreation in the Cold Lake - Beaver River study area (Map No. 1). The assignment has been carried out to perform five inter-related tasks:

1) determine current types and levels of use for various recreation activities;

2) determine recreation needs in the short, medium and long term, in response to development and population growth scenarios;

3) define the physical and operational characteristics of the surface water system presently used for recreation and the requirements for future projected uses;

4) examine the capability of the lakes and rivers to accommodate future recreation uses based on certain water management scenarios; and

5) in conjunction with Alberta Environment, determine the implications for recreation, of implementation of alternative water management scenarios.

The scope of the study is to include private and public recreation use during the summer season. Activities investigated included: swimming, camping, power boating, water skiing, sightseeing/general relaxation, canoeing, picnicking and nature study. Fishing was added to the list of activities as it was found to be a critical activity in determining the total amount of recreation use presently occurring and which might occur in the future.

1.3 Authority

At the request of Alberta Environment, a programme for inventorying and assessing water-based recreation in the Cold Lake - Beaver River study area was prepared by Marshall Macklin Monaghan Western Limited. This programme was presented to R. Hicks, P.Eng., Athabasca Basin Planner. The consultants were authorized to proceed on May 28, 1981.

1.4 Study Area

The study area for the Cold Lake-Beaver River regional water resources study has been determined by Alberta Environment and is illustrated on Map No. 1. The study area was subdivided into sub-areas A and B with detailed analysis of sub-area A and a preliminary analysis of sub-area B to be undertaken in the first phase of the water resources study programme. Therefore, the study area for the recreation element is composed of sub-area A with specific attention focussed on lakes and river courses that may be impacted by water withdrawals associated with development of the Cold Lake heavy oils.

The lakes to be examined include: Cold, Reita, Angling, Muriel, Burnt, May, Marie, Ethel, Tucker, Manatokan, Caribou, Wolf and Moose Lakes. The rivers and streams include: Beaver (Goodridge to the Alberta-Saskatchewan border), Medley, Sand, Wolf and Mooselake Rivers, and Reita, Muriel, Marie (Burnt Lake to Beaver River), Jackfish, (Tucker Lake to Beaver River) and Manatokan Creeks.

1.5 Study Approach

A systematic approach to this study which involved four basic tasks was employed by the consultant, namely:

1) field observations and interviews undertaken at specific lakes within the study area;

2) library research, review of published and other data sources and personal interviews with knowledgeable government personnel and local residents with experience and concerns related to the objectives of the study;

3) co-ordination with the other study components and incorporation of their findings where appropriate; and

4) synthesis, analysis and evaluation of relevant information with a view to preparing an assessment of impacts of water level variations on recreation use of the study area lakes and rivers.

The consultant largely focussed on the sub-system level of investigation (i.e. the individual lakes and rivers) while maintaining a constant comprehensive view of the inter-relationships among the components and the operation of the overall system of recreation opportunities available within the region. It was clearly recognized that direct impacts to the water resources of one lake could significantly reduce its potential for recreation and cause indirect impacts on other lakes due to the increased use.

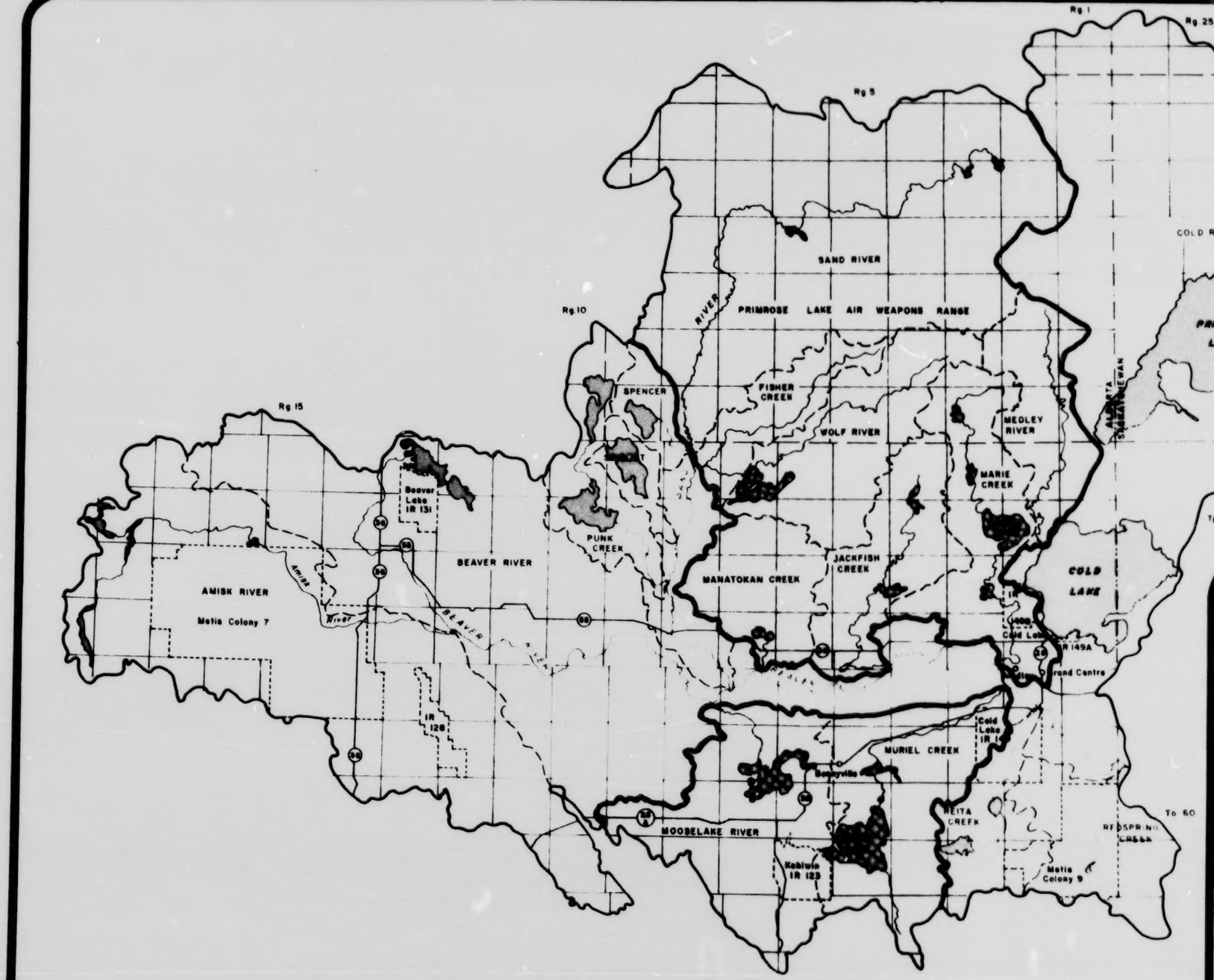
During the course of the study, it became clear that several of the lakes and many of the creeks listed above, are of relatively little significance in meeting public requirements, because of access limitations and/or low recreation capability. Therefore, a further refinement of the study direction was undertaken as a result of the preliminary assessment of the patterns and the extent of recreation use.

In this report, the Beaver River, Sand River, Medley and Marie Creeks and the upper one-third of Mooselake River are the only watercourses with any notable water-based recreation use or capability. Of these, the Beaver and Sand Rivers are by far superior in terms of the quality of recreation experiences provided and receive the most significant use. Therefore, analysis in this study is limited to the above-mentioned watercourses with only minor discussion directed toward the remaining streams.

In investigating the lakes, four land classifications have been derived related to their importance within the water-based recreation system that has evolved in the study area. The hierarchy is based on the level of public and private facility development and the intensity of use generated by these facilities.

The "Major Recreation Lakes" all have at least two of the following four types of recreation development: government-operated facilities, cottages, institutional uses and commercial development. The attraction of the lake's natural capability, along with the facility development, generates in excess of 30 000 user days during the year.

The "Secondary Recreation Lakes" may have one or more of the four types of recreation developments outlined above, however, the scale of facilities and the location, size, appearance and capability of the lake generates less than 30 000 user days per year.



BASE MAP SOURCE: ALBERTA ENVIRONMENT

COLD LAKE-BEAVER RIVER

Water-Based Recreation Assessment

STUDY AREA

- Sub-Area A (including Cold Lake)
- Sub-Area B

Marshall Macklin Monaghan Western Limited

Scale 1: 50,000

Map 1

The "Minor Recreation Lakes" have virtually no public or private facility development and while they have a moderate recreation capability, their location and access makes them difficult to get to (e.g. no signage, poor road or 4-wheel drive road); consequently, use is relatively low.

The "Inaccessible Lakes" are located in the Primrose Lake Air Weapons Range and have no road access. These lakes can only be reached by air and have very low levels of recreation use, if any use at all. Activities are restricted to special programs for Canadian Armed Forces personnel (e.g. survival and search and rescue training, or incidental recreation use by military personnel).

The lakes in each category are listed in Table 1. It should be recognized that other lakes located outside the study area, but in close proximity to those investigated play a significant role in the regional water-based recreation system.

Table 1
Classification of Recreation Lakes

Major Recreation Lakes	Secondary Recreation Lakes
Cold Lake	Angling Lake
Moose Lake	Manatokan Lake
Muriel Lake	Wolf Lake
Marie Lake	
Ethel Lake	
Minor Recreation Lakes	**Inaccessible Lakes**
Reita Lake	Burnt Lake
May Lake	Caribou Lake
Tucker Lake	

The format of this report has been organized in response to the terms of reference recognizing that the study results will comprise only one part of a series of study results to be used to determine water management goals and objectives that will provide for multi-purpose water use. Pertinent results and conclusions will be utilized as part of the input to the Water Balance Model. This mathematical computer model will be used by Alberta Environment to demonstrate the relationship between the supply and demand for water, based on present and future water use requirements, and, to assess the effectiveness and impact of alternative means for balancing water supply and demand.

1.6 Character of Recreation Use

A number of previous studies, notably the Grand Centre - Bonnyville Regional Tourism Plan and several lake management plans by the Regional Planning Division, Alberta Municipal Affairs, and the Provincial Parks Division, Alberta Recreation and Parks, have analyzed various natural, outdoor recreation and tourism resources within that portion of northeastern Alberta located between Lac La Biche and Cold Lake and extending between Townships 59 and 65. The existing and future recreation/tourism resource base is largely derived from the natural characteristics of the many lakes and their shorelines which have high capability for recreation use. The region has the highest concentration of lakes and a disproportionately high percentage of Alberta's high capability shoreline including some of the finest beaches in the province. The region is accessible via good highway links to over one million Albertans living within a 250 km radius. Consequently, many of the lakes of the region have been subjected to various intensities of summer water-based recreation use and development. Predominant activities include camping, fishing, swimming, power-boating, water skiing and picnicking. Typical developments include: public campgrounds, provincial parks, cottage subdivisions, commercial campground/marina/rental cabin resorts, municipal parks and institutional (e.g. church, Boy Scouts, Girl Guides) camps all lying adjacent to various lakes. The season typically extends from the Victoria Day weekend in May to the Labour Day weekend in September, with peaks occurring on weekends, in July, and the first two weeks of August. The major proportion of visitors originate from the Edmonton area, with significant proportions coming from nearby local centres, regional centres and southern Alberta. Over the years, the study area has become recognized and utilized as a summer, water-based recreation destination area by large numbers of Albertans.

Winter recreation use of the study area lakes appears to be minimal, relative to the intense summer usage. Predominant activities, according to the Cottager Surveys for several lakes, include ice fishing, general relaxation, snowmobiling and cross-country skiing. This use generally occurs on weekends with weather and accessibility to the lakes being major determinants of the amount of use.

It is within this context that this study of recreation water demands and water management impacts must be viewed.

2. EXISTING FACILITIES AND USE PATTERNS

2.1 Introduction

The following chapter describes the current development of recreation activity in the Cold Lake - Beaver River study area. The utilization of the water resources in this region is considered in terms of existing public and private facilities, the water-based activities of local residents and visitors to the region including proposed recreation developments and programmes, and identified use patterns and preferences. Short-term trends in recreation activities and facility development are identified and the implications for the future are addressed in a preliminary manner. The future growth of recreation activities and needs is discussed in Chapter 3.

2.2 Existing Facilities and Operations

Present water-based development, which is centred almost exclusively on the region's lakes, can be divided into public, private, institutional and commercial uses. Public development is varied, ranging from provincial parks with a well-developed array of facilities, to the typical Alberta Transportation Campgrounds with very basic facilities. Private development is primarily comprised of lakefront cottages and commercial enterprises which serve the recreation requirements of vacationers. The commercial enterprises discussed are located on, or immediately adjacent to, the study area lakes.

As a general overview of the resource capability and facility development, an inventory has been prepared outlining the major conditions for each lake (Figure 1). Map No. 2 locates the recreation areas and facilities in the study area.

2.2.1 Public Facilities

Various government agencies provide recreation facilities on the study area lakes. Figure 2 describes the facilities at each location. The agency with the largest number of sites is Alberta Recreation and Parks, with eleven camping areas or Provincial Parks on five lakes with a total

of about 400 campsites.(1) The majority of the camping areas were recently transferred from Alberta Transportation, and offer a very basic standard of facilities for day users and campers, such as picnic shelters, barbecue stands or fire rings, picnic tables, pit toilets and hand pumped water. Water access is provided usually from a beach used for swimming and boat launching. Some areas are well treed (e.g. Moose Lake, Franchere Bay), while others are little more than gravel and earth-covered clearings. Many of these sites were originally designed as overnight stops for travellers, but use patterns have changed to the point where many are now considered to be destination stops by visitors to the Cold Lake - Beaver River area. Thus, usage intensities have far exceeded the original purpose. As a result, design and maintenance standards have been inadequate for peak season visitation. Recreation and Parks plans on upgrading these facilities in the near future.

There are two provincial parks in the study area with higher standards of design and maintenance than Transportation campgrounds, one on Moose Lake and one on Cold Lake (Map 2). Moose Lake Park facilities include 59 camping and trailer units with fireplaces and tables, swimming areas for campers and day visitors, a picnic area, boat launch and hiking trails (Figure 2).

Cold Lake Park was officially opened in 1977 and facilities are still being developed. Present amenities include a day use area with picnic tables, beach area and flush toilets, a boat launch, 117 tent and trailer sites, and hiking/cross-country ski trails.

The Municipal District (M.D.) of Bonnyville provides both camping and day use facilities (picnic tables, beach area) on Moose and Cold Lakes, with the Town of Cold Lake offering day use and basic camping facilities as well on Cold Lake.

---

(1) Statistics for some of the sites were provided by Alberta Transportation in June, 1981, while these sites were still administered by them. It must be recognized that many of the campgrounds do not presently have individual sites and that on popular occassions, the total number of camping parties may significantly exceed the number of sites noted.

Cold Lake - Beaver River

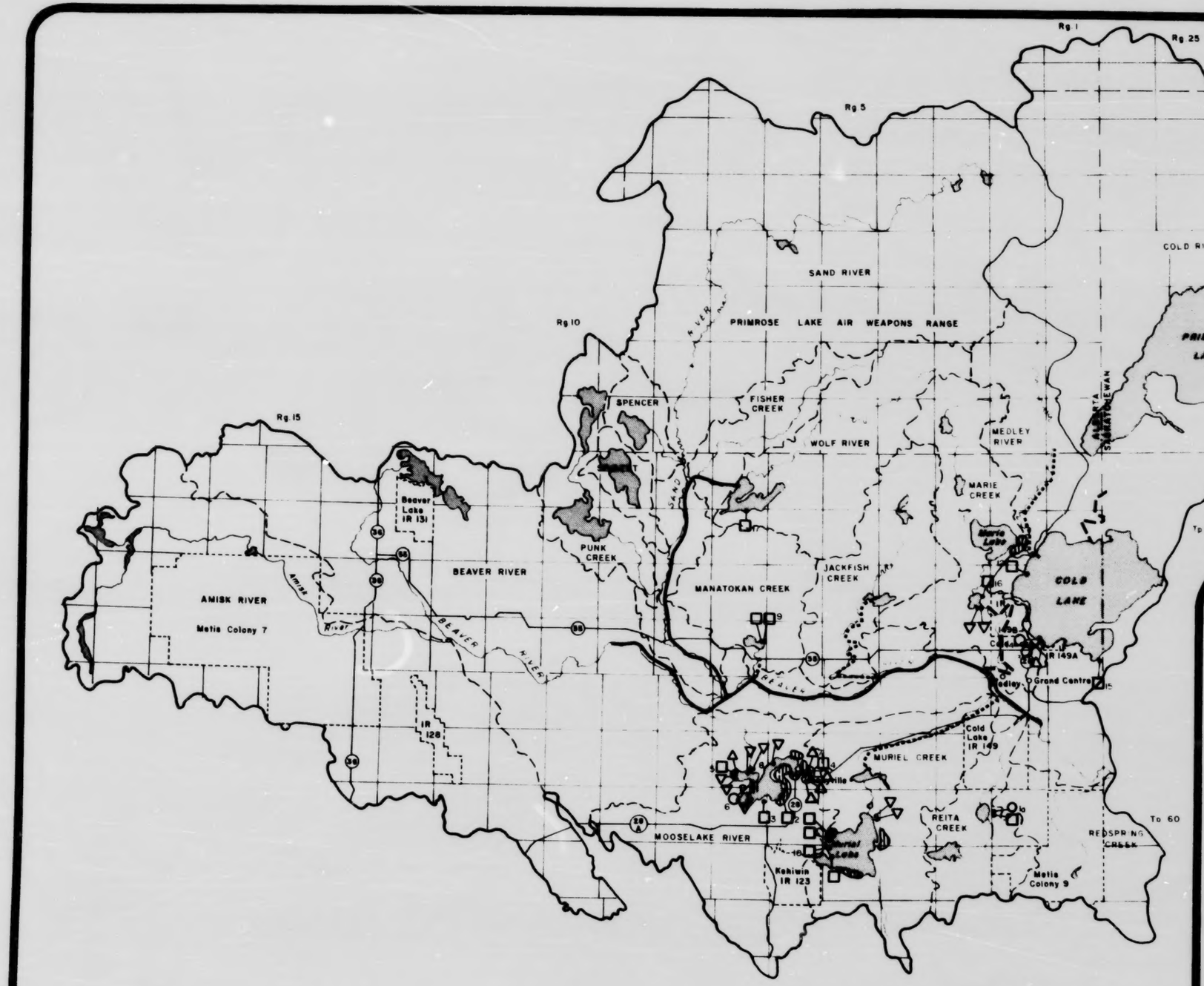
Water - Based Recreation Assessment

Resource Capability/ Facility Inventory

Figure 1

	SIZE		EXISTING RECREATION FACILITIES											ACCESS				SHORELINE RECREATIONAL CAPABILITY			SPORTFISH CAPABILITY		
	Area (ha)	Shoreline Length (km)	Permanent Residences	Cottages (less than 50 lots)	Cottages (greater than 50 lots)	Alta. Rec. & Parks Campground	Provincial Park	Transportation or Forest Service Campground	Municipal Park or Campground	Commercial Campground/Resort	Marina	Informal Campground	Institutional Camp	All-Weather Road	4-Wheel Drive	Seasonal	Air only	C.L.I. Class I	C.L.I. Class II	C.L.I. Class III	C.L.I. Class IV	other	C.L.I. Class I	C.L.I. Class II	other
MAJOR RECREATIONAL LAKES																									
Marie Lake	3419	28.6			●					●				●				●	●	●	●		●		
Cold Lake	37270	89.6	●		●	●	●		●		●	●		●				●	●	●	●	●	●		
Moose Lake	3730	64.5	●		●	●	●		●	●	●		●	●				●	●	●	●	●	●		
Muriel Lake	6413	49.4	●		●	●				●		●	●	●				●	●	●	●	●	●		
Ethel Lake	480	10.1	●	●		●							●	●					●		●	●			
SECONDARY RECREATIONAL LAKES																									
Angling Lake	596	9.0					●	●						●					●		●	●		●	
Manatokan Lake	471	7.1	●				●		●					●					●		●			●	
Wolf Lake	3365	45.0					●				●			●					●	●	●	●	●		
MINOR RECREATIONAL LAKES																									
Reita Lake	1165	19.6									●					●				●	●	●		●	
May Lake	313.0	8.0									●				●	●				●	●	●	●		
Tucker Lake	630	15.4									●				●	●				●	●	●		●	
INACCESSIBLE LAKES																									
Burnt Lake	453	9.3														●			●	●	●	●			
Caribou Lake	445	13.8														●									

*Provincial Campgrounds = Rec. & Parks, Forest Service & Transportation Campgrounds



BASE MAP SOURCE: ALBERTA ENVIRONMENT

COLD LAKE-BEAVER RIVER

Water-Based Recreation Assessment

RECREATION INVENTORY

PUBLIC RECREATION FACILITIES

- 3 Public Recreation Facilities Reference Number
- ALBERTA Provincial Park
- □ ALBERTA Recreation & Parks, Forest Service or Transportation Campground
- ○ Municipal District Campground or Day Use Area

PRIVATE RECREATION FACILITIES

- △ Commercial Campground/Resort/Marina
- ▽ Institutional Camp
- ||||||||| Cottage Subdivision

EXISTING RIVER RECREATION USE

- ——— High to Moderate Recreational Use
- – – – Moderate to Low Recreational Use
- ····· Low to Nil Recreational Use

Marshall Macklin Monaghan Western Limited

Scale 1:50,000

Map 2

Public Recreational Facilities Inventory Matrix

Figure 2

LAKE	DRAWING CODE NUMBER	JURISDICTION	AREA (ha)	DAY USE ONLY	CAMPSITES	SWIMMING BEACH	BOAT LAUNCH	PICNIC SHELTER
ANGLING LAKE	1	Alta. Rec. & Parks	2.0		10			1
ANGLING LAKE	1a	Village		●		●		
MOOSE LAKE								
- Bonnyville Beach	2	Alta. Rec. & Parks	0.4		8	●		1
- Eastbourne	3	Alta. Rec. & Parks	2.3		15	●		1
- Vezeau Beach	4	Alta. Rec. & Parks	0.6		20			2
- Franchere Bay	5	Alta. Rec. & Parks	22.3		80	●	●	1
- Pelican Point	6	Municipal District	22.6		100	●	●	●
- Vezeau Beach	7	Municipal District	0.3	●		●	●	
- Moose Lake	8	Provincial Parks	774.0		59	●	●	
MANATOKAN LAKE	9	Alta. Transportation	1.0		15	●	●	●
MURIEL LAKE	10	Alta. Rec. & Parks	0.8		16	●	●	●
COLD LAKE								
- Cold Lake	11	Provincial Parks	395.0		27	●	●	
- English Bay	12	Alta. Rec. & Parks	17.9		50	●	●	●
- Kinosoo Beach and Centennial Park	13	Town of Cold Lake		●		●		
- Cold Lake	14	Municipal District						
- French Bay	15	Alta. Rec. & Parks	3.9		10	●	●	
ETHEL LAKE	16	Alta. Rec. & Parks	.45		14	●	●	●
WOLF LAKE	17	Forest Service	20.2		60	●	●	●

The Alberta Forest Service operates one recreation site within the study area (and several more in the lakes immediately to the west) located at Wolf Lake. There are 60 camp and trailer sites, a boat launch and swimming area.

2.2.2 Private Facilities

Cottaging is the most common type of private recreation use of the study area shorelands. Major cottage subdivisions have been developed since the 1960's focussing mainly on Moose, Muriel, Cold and Marie Lakes.

Moose Lake is the most intensively developed lake with 32 different subdivisions and a total of 713 cottage lots of which approximately 200 (28%) have been developed. Marie Lake has 56 registered lots and Cold Lake has 55 registered lots.(2)

Other types of private development include institutional camps, mainly run by church groups, and a tent and trailer campground (104 sites) operated at Marie Lake for the sole use of the Canadian Armed Forces personnel. There are ten institutional camps on the study area lakes, six on Moose Lake and two each on Muriel and Ethel Lakes.

There are ten commercial operations located on four of the study area lakes. Details of the facilities and services provided by these establishments are outlined in Figure 3 and described in Appendix A. Generally, these operations serve the needs of campers and visitors engaged in water-based recreation activities. Seven of the ten businesses offer campsites and/or roofed accommodation in conjunction with beaches and boating facilities (e.g. launch ramps, docks, gas/oil). It must be recognized that there is a large number of businesses (food, lodging, gas/oil, etc.) that are dependent on business generated by the tourists to the area even though they may not be located on any of the lakes in the study area. No investigation however has been undertaken of these facilities.

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(2) Information on the number of lots on which cottages have been developed was not available for Cold and Marie Lakes.

The various commercial operations generally offer the quality, appearance and type of facilities and services suited to the needs of the regional and provincial recreation market sectors. The facilities are typically family oriented, allowing visitors to be largely self sufficient, not requiring major expenditures for the holiday period. The only exception is Silver Birch Cove on Muriel Lake. This is the only operation providing a high quality setting and standard accommodation capable of attracting the high expenditure market segments.

2.3 Current Recreation Use

In this section, the available data collected by various government agencies is examined in conjuction with field data gathered by the consultant. The information supplied by the Regional Planning Section of Municipal Affairs through their lake management studies, such as the cottager questionnaires and their analysis of use patterns, was particularly useful in this regard. Provincial park attendance statistics were reviewed along with estimates of use provided by Alberta Transportation and Forest Service for their respective campgrounds. In addition, the consultant interviewed sixty campers at ten of the study area lakes during the nine days between June 28 and July 6, 1981. Ten of the commercial operators and fifteen cottagers were also interviewed to augment the background data required to develop an understanding of user profiles and activity patterns. Copies of the consultant's questionnaires and an analysis of the responses are located in Appendix A.

Various types of techniques have been applied in order to establish existing recreation use levels and the major types of activities for each lake. Quantification of use levels for each water-based activity type has been attempted, although it must be realized that with the limitations of the data base, the results will be very qualified estimates. Known activity patterns on similar lakes have been used as a base to estimate the patterns for lakes with little or no data available. Any discernable short-term trends will also be noted.

Three major types of recreation users will be examined, namely; campers, cottagers and day users. The major summer activities found to be of importance to these recreationists are fishing, swimming, camping, power

Commercial Operator's Facilities & Services

Figure 3

LAKE	DRAWING CODE NUMBER	MOTOR BOAT RENTAL	CANOE/ROWBOAT RENTAL	DOCK	BOAT LAUNCH	GAS/OIL	GENERAL STORE	SNACK BAR	FAST FOOD RESTAURANT	UNSERVICED CAMPGROUND	SERVICED CAMPGROUND	MOTEL (UNITS)	CABINS/COTTAGES
MOOSE LAKE													
Normand Beach Resort				●	●	●				●			
Vezeau Beach Resort		4		10'	●	●		●			9		8
Moose Lake Motel		4		60'								2	3
Beacon Beach		5		75'	●	●		●					
Pat's Burger Bar								●	●				
MURIEL LAKE													
Spring Beach		4	/1	10'	●	●		●		30			8
Silver Birch Cove					●						10		9
Kopala Beach Resort		7	3/	40'	●	●	●	●		35			14
COLD LAKE													
Frank's Marina		9	2/2	450'	●	●		●					
MANATOKAN LAKE													
Bonanza Beach			/3					●		10			2

boating, water skiing, general relaxation, picnicking and canoeing. Other activities such as hiking and nature study had the lowest rates of participation and are not directly related to lake levels.

The level of investigation or analysis varies substantially from lake to lake according to the amount of existing public and private development as well as the amount of published data.

2.3.1 Moose Lake

This is the most intensively developed lake in the study area. It supports Municipal and Provincial parks, Alberta Recreation and Parks campgrounds, commercial operations, institutional camps and approximately 200 private cottages. The major source of information on use of the lake was a series of surveys carried out by Municipal Affairs during the summer of 1975 in which cottagers, day users and campers were interviewed. Although somewhat dated, the information derived is considered relevant today as the public facilities remain largely the same in terms of their capacities, with the only significant difference being the increased number of cottages during this time period.

In terms of cottage use, the survey (Municipal Affairs) revealed that over 41% of the cottage owners were from the Edmonton market area and about 39% were from the local area (within 80 km of the lake). Significant use of the lake by cottagers begins on the Victoria Day weekend and extends to Labour Day, with an average of 5 to 6 people per cottage present on weekends. Mid-week use largely occurs during July and August averaging over 2.5 people per cottage. Based on summer use estimates (May to October), each cottage generates about 0.69 person years of use (252 user days/year) for a total of about 50 400 cottager days. Occupants of cottages accounted for about 47% of total lake weekend use and 64% of total lake mid-week use.(3)

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(3) Moose Lake Management Study, Municipal Affairs, 1977.

The most popular summer recreation activities for cottagers are considered to be swimming, fishing, power boating, water skiing and general sightseeing with 60% to 82% taking part in these activities (Table 2). No activity information is available for park users, however, observations by Parks staff confirm that fishing and swimming are the two most frequent activities engaged in by the public.

Cottagers account for a considerable amount of boating use on the lake with an average of 1.55 boats of various types per cottage. Survey results indicate that half the total were high power pleasure craft, slightly less than half were canoes, rowboats or sailboats and less than 5% were low horsepower fishing boats.

Of the campers and day users surveyed in the 1975 Municipal Affairs Survey, 59% of the units interviewed (a total of 1 277 individual units were surveyed) were from the Edmonton market area with less than 10% residing within 65 km of the lake.

During the nine day sample period in August of 1975, over 5 100 individuals used the public facilities at Moose Lake, with campers accounting for 77.8% of the total use. Almost 70% of total use occurred on weekends with the Franchere Bay Recreation and Parks campground, the most heavily used area accounting for over 70% of total campsite use.

According to the consultant's informal survey (1981), fishing was the most important activity, followed by swimming, general relaxation and water skiing. Seven of the eight groups surveyed had boats, six of which were fishing-type runabouts. When asked if they would still visit the lake if the favourite activity could no longer be carried out, five respondents stated that they would still visit Moose Lake, generally citing the value of the social aspects and the general pleasant quality of the area as important features. Three groups stated they would go elsewhere.

The Municipal Affairs questionnaire included questions pertaining to perceptions of use levels. For the cottagers, 75% felt the lake was over-used on holiday weekends. This figure dropped to 22% for remaining weekends during the summer period.

Table 2

Popular Summer Recreational Activities - Cottagers

ACTIVITY \ LAKE	MOOSE LAKE		MURIEL LAKE		MARIE LAKE	
	Rank	% Partici-pating	Rank	% Partici-pating	Rank	% Partici-pating
Swimming	1	81.8	1	93.1	1	97.6
Fishing	2	77.8	2	85.2	2	88.1
Powerboating	3	69.7	3	69.0	4	61.9
Waterskiing	5	63.6	5	55.2	5	59.5
Sightseeing/General Relaxation	4	59.6	4	62.1	3	78.6
Canoeing	6	39.4	6	41.4	6	59.5
Sailing	7	30.3	9	13.8	11	28.6
Camping*	8	19.2	8	22.2	12	38.1
Picnicking	9	26.3	7	27.6	8	45.2
Nature Study	12	13.1	12	17.2	9	33.3

* Camping on undeveloped cottage lots

SOURCE: Regional Planning Section, Municipal Affairs, Cottager Surveys

Existing use patterns and trends can be identified from statistics available from the 1975 and 1981 recreation seasons. In 1975, it was estimated that Moose Lake was used by 2 400 to 2 600 people per day on most summer weekends, and by about 800 to 850 per day during the mid-week period with cottagers accounting for 47% and 64% of the use respectively. This amounts to an annual summer use (mid-May to September) of between 143 200 and 150 800 user days.(4) This estimate excludes commercial accommodation and institutional camp use which would account for approximately 7 945 user days.(5) Based upon the estimated increases in use for the Provincial Park and the Recreation and Parks campgrounds between 1975 and 1981, and, the estimated 1981 Commercial and Institutional use, the estimated total use of Moose Lake in 1981 was 209 500 user days.

The significant difference between use levels recorded in 1975 and 1981 are due to the increase in the number of developed cottages and the increase in the amount of camper and day use visitors. The significant increase in camper and day use visitation in the past six years is confirmed by the increase in use of Provincial Park facilities and the Recreation and Parks campgrounds shown in Figures 4 and 5 and Table 3.

Camper use of Moose Lake Provincial Park increased by 19.6% between 1976 and 1981, with 1981 being the peak year. During summers with good weather, this park operates near, or at capacity for much of July and August.

The phenomenal increase in the day use visitation during 1977-1980 is due largely to a change in the recording system and an improvement in the facilities. No reason was given for the drastic decrease in day use for 1981.

The use levels of the four Recreation and Parks campgrounds have also increased substantially between 1977 and 1979. The aggregate increase was 14.6%, with the Franchere Bay campground receiving the greatest proportion of this use (Table 3).

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(4) Estimate based on 34 summer weekend days multiplied by 2 400 to 2 600 user days in addition to 73 mid-week days multiplied by 800 to 850 user days.

(5) Estimate based on these approximations: Moose Lake Motel, 650 user days; Vezeau Beach Resort, 2 295 user days; six institutional camps, 5 000 user days.

Table 3

Campground Use
Alberta Transportation/Recreation & Parks

CAMPGROUND	1977		1979		% CHANGE
	ESTIMATED VEHICLE USE	ESTIMATED NUMBER[1] OF CAMPERS	ESTIMATED VEHICLE USE	ESTIMATED NUMBER[1] OF CAMPERS	
Angling Lake	448	1,433	520	1,664	+16
Moose Lake (total)	8,016	25,650	9,199	29,437	+14.6
-Bonnyville Beach	580	1,856	585	1,872	+1
-Eastbourne	968	3,098	1,142	3,655	+18
-Vezeau	1,452	4,646	1,464	4,685	+1
-Franchere	5,016	16,050	6,008	19,225	+20
Muriel Lake	1,100	3,520	1,100	3,520	0
Cold Lake, English Bay	2,096	6,707	1,502	4,806	-28
Ethel Lake	660	2,112	340	1,088	-48
Manatokan Lake	1,600	5,120	1,800	5,760	+12

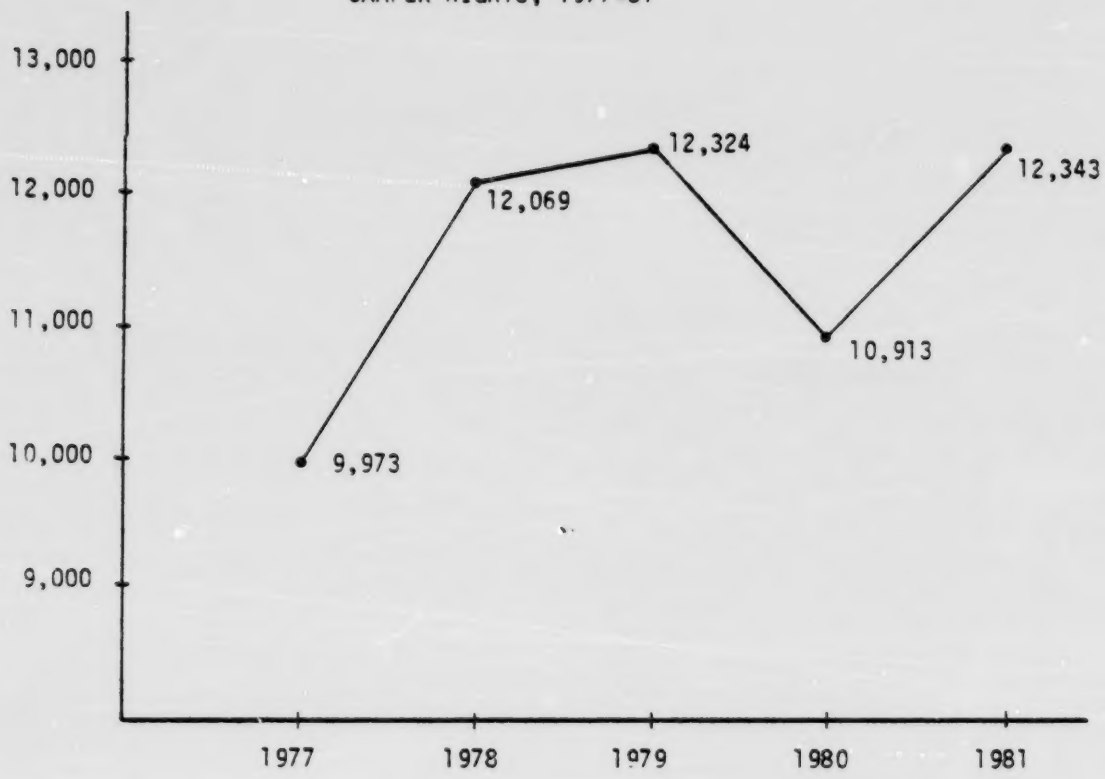
1) Based on numbers of vehicles times 3.2 persons per vehicle. 3.2 is the average camper party size for Moose Lake and Cold Lake Provincial Parks between 1977 and 1980.

SOURCE: Alberta Transportation - Regional Transportation Services

FIGURE 4

MOOSE LAKE PROVINCIAL PARK

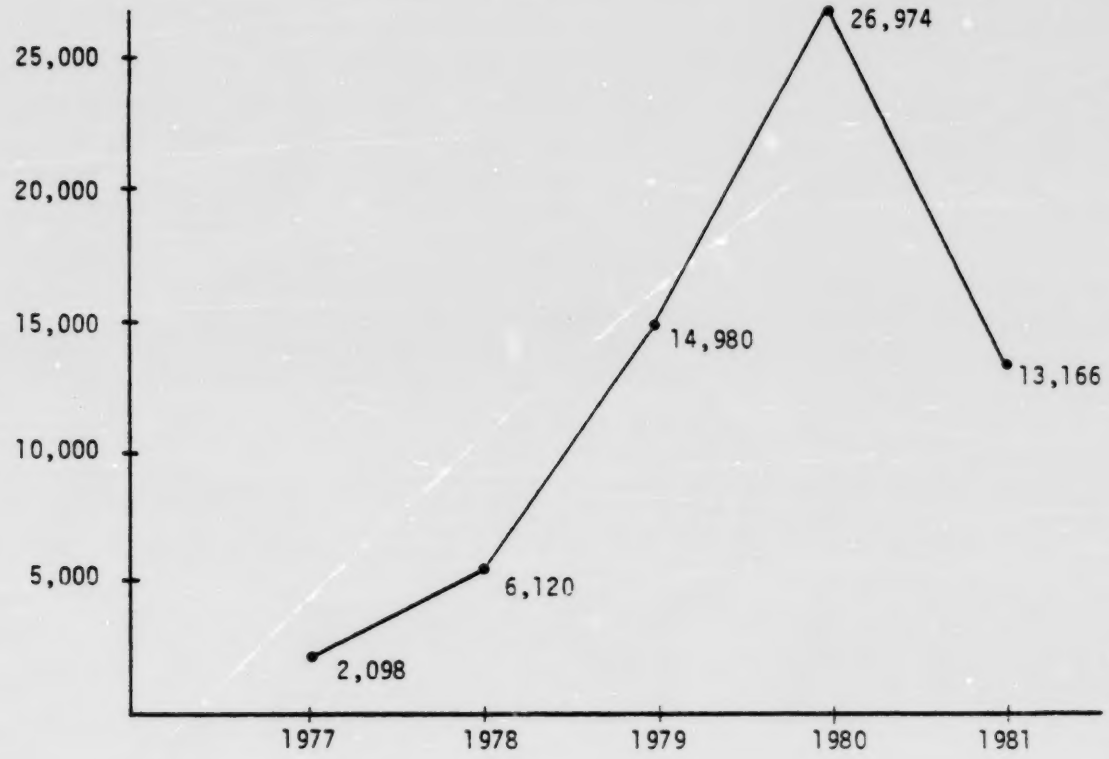
CAMPER NIGHTS, 1977-81



SOURCE: Alberta Recreation and Parks, Parks Division, Provincial Park User Statistics 1977-1980 (1981 figure from preliminary data).

FIGURE 5

MOOSE LAKE PROVINCIAL PARK
ANNUAL VISITOR DAYS (DAY USE)



SOURCE: Alberta Provincial Parks, Annual Visitor Statistics (1981 figure from preliminary data - August use was down significantly over previous years).

Using the data on cottage participation in various activities (no other suitable breakdown of participation rates is available), it is possible to arrive at a breakdown in the total number of people participating in each major activity. The figure for camping will, of course, be adjusted to allow for the proportion of users who are campers.

Moose Lake is presently commercially fished for whitefish, walleye, pike and tullibee.

Table 4 illustrates the number of participants in each activity during the 1981 season.

Table 4

Estimated Number of Total Participants - Moose Lake

Activity	Total Participants (*Activity Occasions)
Swimming	171 371
Fishing	162 991
Camping	69 234
Power Boating	146 230
Water Skiing	133 432
Sightseeing/General Relaxation	125 040
Canoeing	82 661
Picnicking	55 177
Nature Study	27 483
	973 619

* This term, "Total Participants", used by Municipal Affairs, is misleading. This term estimates the number of occasions in which lake visitors engaged in an activity. "Activity Occasion" is a more appropriate term and is used throughout this report.

Using the 1975 estimates, 59.1% of the total use during the summer season may be attributed to cottagers and their guests, 22.0% to campers, 11.1% to day users and 7.8% to commercial resort and institutional visitors.

2.3.2 Muriel Lake

Muriel Lake is located approximately 225 km northeast of Edmonton and about 20 km southwest of Moose Lake. It is larger than Moose Lake, being about 6 400 ha in area, and considerably less developed although it does

have several cottage subdivisions, a public campground, commercial operations and institutional camps. There are still large areas of undeveloped shoreline and this character along with its large size, good beaches and excellent water quality cause Muriel Lake to be regarded as one of the most scenic and most appealing lakes in the study area. Muriel Lake is presently commercially fished for whitefish, pike and ling.

The major source of information used in this study for Muriel Lake has been the lake management study prepared by the Regional Planning Section of Municipal Affairs, November 1979, and background studies such as a cottager survey carried out in 1975 and updated in 1979. This data was supplemented by field observations and interviews with campers, and interviews with three commercial operators completed in July, 1981.

Analysis of results obtained in the 1979 survey of cottagers and other land owners, indicate that recreaton use patterns have not changed significantly since 1975 with similar peak usage and similar numbers of users per cottage. The one major difference is that the number of developed cottages which has more than doubled from about 50 to 110 units.

The number of cottages and cottage-related activities will inevitably increase as a total of about 337 registered lots were still undeveloped in 1979. In addition to the cottagers, there are 75 property owners living near the lake. A survey in 1979 revealed that 80% (60) of these land owners used Muriel Lake for recreation activities. Their use patterns will be discussed in conjunction with the cottagers.

The majority of the lake users (62%) are from within the immediate region (e.g. Bonnyville) and its adjacent area (Elk Point, St. Paul), with Edmonton area residents comprising about 25% and people from distant centres (Medicine Hat, Calgary), the remainder. Significant use begins about the Victoria Day weekend and extends to the Labour Day weekend, with July and August being the months of heaviest sustained use. There are marked peaks each weekend during the summer. Some variation may be noted on an annual basis as a result of weather conditions. This pattern is typical for virtually all the lakes in the study area.

The most popular summer recreation activities for cottagers were swimming, fishing, power boating and sightseeing, with 92 to 93% taking part in these activities (Table 2). Cottagers account for considerable boat use

on the lake with 91% using boats with an average of 1.68 boats per cottage. The permanent residents have approximately 1.36 boats per household. There are about 70 motor boats operated by cottagers and permanent residents, about 37 of which are power boats (over 25 hp). There are also about 45 canoes, 30 rowboats and 11 sailboats.

The 1979 Alberta Municipal Affairs survey and an informal survey of eight campers undertaken by the consultant in 1981 serve as the primary source of information for campers and day users. The most popular activities are swimming, water skiing, fishing and power boating. Most campers and day users had boats (approximately 90%) which were about equally divided between water ski boats and low horsepower fishing boats.

The most heavily used areas were the Parks and Recreation campground, the informal campground along the southeast corner of the lake, which accounted for about 60% of the camping use, and the three commercial operations.

Indicators of existing use patterns and trends were included in part of the management study completed by Alberta Municipal Affairs. This study included a general estimation of the total recreation use on Muriel Lake. On average weekends in June, July and August, it was estimated that approximately 770, 935 and 820 people respectively use the lake each day. On long summer weekends, this figure reaches a peak of between 1 050 and 1 150 per day. The approximate proportions for the long weekends are 69.6% for cottage users and property owners and 30.4% for campers. Using these figures, the total usage for the summer season (Victoria Day to Labour Day) is approximately 39 600 user days.

The number of cottagers, who comprise 62% of the lake users, is expected to more than double as the existing registered lots are developed. Also, the eventual development of a provincial park on the southeast corner of the lake can be expected to at least double the amount of campers. Gradual expansion of commercial facilities can also be expected. Thus, future summer use of the lake could reach 84 100[(6)] user days within 10 to 15 years depending on the pace of construction of new cottages and development of the proposed provincial park.

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(6) Based on multiplying the numbers of cottagers by 2.2 which is equal to undeveloped cottage lots, and by multiplying the number of campers by two.

Using the data on cottager participation in various activities and the preferred activities of the campers, it is possible to arrive at a breakdown of the total number of people participating in each major activity. The following table provides estimates of the number of occasions in which lake visitors engaged in the major recreation water-based activities during the 1981 season.

Table 5
Estimated Number of Activity Occasions for Muriel Lake

Activity	Activity Occasions
Swimming	36 870
Fishing	33 740
Sightseeing/ Relaxation	24 590
Power Boating	24 460
Camping	20 620
Water Skiing	17 315
Canoeing	12 420
Picnicking	8 280
Nature Study	4 975
Sailing	3 390
	186 660

In response to the questions related to the perceptions of use levels, for both cottagers and permanent residents, only 16% of respondents felt the lake to be over used on average weekends, although this number increased to 33% for long weekends. About half felt the lake was generally adequately used in accordance with its capacity.

2.3.3 Cold Lake

As the largest lake in the study area, Cold Lake has a surface area of 35 270 ha and a total shoreline length of 89.6 km. The Alberta portion consists of approximately 24 390 ha and 67.8 km of shoreline. All of the developed access points are located on the Alberta side of the lake, so all use estimates are considered to be Alberta's.

The Town of Cold Lake (1981 population 2 110), is located on the southeast end of the lake and directly on Highway No. 55. Other population centres in the immediate vicinity include the Canadian Forces Base Medley (population 5 500) at 5 km and Grande Centre (population 3 146) at 10 km.

Cold Lake and Grand Centre provide extensive tourist provisions which supplement the public and private water-based recreation facilities located at the lake.

Recreation opportunities are provided by the provincial park and by the Town of Cold Lake and the M.D. Cottage subdivisions are located at Cold Lake along the west shore, just north of the Town. It is difficult to accurately estimate the total amount of recreation use occurring on Cold Lake due to the lack of reliable statistics. Information provided by the various jurisdictions indicates an annual use (1981) of approximately 77 160 user days.

Cold Lake Provincial Park is located just east of the Town of Cold Lake. This park provides 117 designated campsites, a swimming beach and boat launching facilities. As the park is relatively new (1977), visitor awareness is still considered low. The 1981 total visitation was about 40 260[7] wth 92% of the visitation being day use in nature.

Two other public campgrounds at Cold Lake are English Bay and French Bay. Recently transferred from Alberta Transportation to Recreation and Parks, the facilities are located north and east of the Town of Cold Lake along gravel roads. Recreation amenities provided include a total of 60 campsites, boat launch, swimming beaches and picnic shelters. Use statistics provided by Transportation indicated a decline in use from 1977 to 1979. However, 1981 figures of 10 400 campers show an increase in use even over the 1977 levels. French Bay has been closed for the last several years, but will be reopened by Recreation and Parks in the near future.

The Town of Cold Lake provides swimming beaches along Kinosoo Trail and at Kinosoo Park and camping at Centennial Park with a total estimated annual use (1981) of 15 650 visitors. The M.D. Park provides a beach and public dock which accommodated an estimated 10 850 visitors in 1981.

The use patterns at Cold Lake generally do not follow the same patterns of other recreation lakes in the study area. With the close proximity of the population centres, day use at 76% exceeds camping use by a large margin. The Provincial Park will continue to experience more use as increasing numbers of recreationists become aware of the park and as more facilities are developed.

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(7) Preliminary data from Alberta Provincial Parks.

The total estimated annual use of Cold Lake on the Alberta portion is 77 160 visitors. Table 6 identifies the estimated number of activity occasions for Cold Lake based upon this annual use.

Table 6
Estimated Number of Activity Occasions for Cold Lake

Activity	Activity Occasions	Estimated[8] Proportion of User Days
Swimming	77 160	100%
Fishing	60 180	78%
Sightseeing/Relaxation	46 290	60%
Picnicking	20 060	26%
Power Boating	19 290	25%
Camping	18 420	Actual Count
Water Skiing	15 430	20%
	256 830	

2.3.4 Wolf Lake

Wolf lake is located on the Wolf River, a tributary of the Sand and Beaver Rivers, in the northwest section of the study area. The lake is accessible by a 16 km gravel road from Highway No. 55 and is approximately 65 km from the Town of Cold Lake. Wolf Lake has a surface water area of approximately 3 365 ha and is relatively deep compared to other lakes in the immediate area, with an average depth of 10 m and a maximum depth of 40 m. The irregular shape of the lake, good water quality (Secchi disk - 2.7 m), attractive treed shoreline and sand beach area make the lake very attractive for recreationists.

It is difficult to accurately estimate the total amount of recreation use occurring on Wolf Lake as well as the use levels for various activities, due to the lack of reliable statistics.[9] Interviews with campers as well as with other knowledgeable individuals and government staff have been used to compliment the existing data base.

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(8) Percentage estimates derived from Moose Lake which experiences similar visitation patterns - adjusted to reflect observed Cold Lake usage.

(9) Information received from Mr. L. St. Antoine, Forest Recreation Planner, August 6, 1981, indicates that user statistics developed by the Forest Service should be used only to indicate trends regarding general use levels on weekends versus weekdays.

Statistics obtained indicate that during the period from 1978 until the present time, the average use of the campground has been 42 parties/weekend and 16 parties/weekday. Some day use by local residents is noted at the picnic area but no estimate for this use is available from the Alberta Forest Service.

The lake has approximately 120 - 150 ha which has been developed as a Forest Service campground, picnic area and boat launch. The remainder of the shoreline has not been developed. The entire shoreline is held by the Crown.

The available statistics suggest that from May to September, the campground is heavily utilized on weekends, with a large number of units in the overflow and picnic areas. Further, campers often locate at popular points of land and beaches along the east shore of the lake. During the long weekends, as many as 175 parties have been recorded. It would appear that over the past three years, there has been a minor increase both on the weekend and during weekdays. Occupancy rates for the campground has varied significantly from month to month and from year to year without a clear pattern being established.

Present use patterns indicate that the majority of recreationists come to the lake for fishing, camping, swimming and boating. Interviews conducted by the consultants indicated without exception, fishing was the most popular activity and the main reason for camping at this particular lake. The interviews also confirmed that swimming was the second most popular activity followed by general site seeing/relaxation and finally boating for pleasure.

Although not noted in the interviews, analysis of the Forest Service Campground attendance statistics indicate that hiking, canoeing, hunting (September), and water skiing were popular activities recorded by the campground attendant.

Based on past trends, it is estimated that in 1981, total use on the lake amounted to 10 380 user days. Although Wolf Lake is located at the top of the Wolf River canoe route, it is estimated that this activity only generated an additional 55 user days for a total use of 10 435 on Wolf Lake. The activity pattern as shown in Table 7 outlines the occasions of recreation activities.

Table 7
Estimated Number of Activity Occasions for Wolf Lake

Activity	Activity Occasions	Estimated Proportion of User Days
Fishing	9 913	95%
Camping	9 913	95%
Swimming	9 391	90%
Sightseeing/Relaxation	7 826	75%
Power Boating	3 130	30%
Water Skiing	1 043	10%
Canoeing	521	5%
Picnicking	521	5%
	42 258	

2.3.5 Angling Lake

This lake, located 20 km south of Highway No. 28 on Secondary Road 897, is somewhat removed from the main travel routes. As a result of its location and gravel access road, the lake does not receive a significant amount of tourist use from pass through traffic. Existing public recreation development consists of Beaverdam Centennial Park - a small day use park used by nearby residents of the hamlet of Beaverdam and a small (2 ha) Recreation and Parks campground with 25 campsites (recently transferred from Alberta Transportation). A commercial campground is situated on the southeast part of the lake but it has not been in operation for several years. There are no cottages or permanent residences at the lake.

Access to the water from Beaverdam Centennial Park is very difficult as there is no beach and the shoreline is composed of a 1.5 m steep rounded bank. There is no boat ramp although boats are launched by fishermen with some difficulty.

The campground statistics obtained from Alberta Transportation for the Recreation and Parks campground (Table 3) suggest that there has been a 16% increase between 1977 and 1979 with about 1 660 campers in 1979. The lake is also used by the residents of Beaverdam, especially the children, during the month of July but it is reported that "swimmers itch" generally precludes water contact activities by the beginning of August.

According to information obtained from nearby residents, the Recreation and Parks campground is used primarily in the months of May and early

June, largely by non-resident fishermen. Some local residents also fish in the lake during this period. Use of the lake resources significantly decreases in July and August and it is the opinion of the local residents that since 1979, total visitation has been decreasing.

It is estimated that the lake receives about 2 000 to 2 500 days of recreation use each summer season with visitors engaged largely in camping, fishing, and swimming.

Table 8 outlines the activity occasions currently estimated for Angling Lake. It must be recognized that existing use figures are not considered highly accurate and that this problem is further compounded by a lack of reliable trend data on activity patterns of recreationists on Angling Lake.

Table 8
Estimated Number of Activity Occasions for Angling Lake

Activity	Activity Occasions(10)
Fishing	2 090
Sightseeing/Relaxation	1 875
Camping	1 700
Swimming	1 490
Picnicking	720
Power Boating	170
Canoeing	125
	8 170

(10) Based on 2 500 user days of which 1 700 are camper days and 800 are day use with activity estimates as follows:

Fishing	@ 90% of campers and 70% of day users
Sightseeing/Relaxation	@ 75% of user days
Camping	actual count
Swimming	@ 50% of campers and 80% of day users
Picnicking	@ 90% of day users
Power Boating	@ 10% of campers
Canoeing	@ 5% of user days

2.3.6 Manatokan Lake

Manatokan Lake is located 36 km northwest of Bonnyville and 4 km north of Highway No. 55 on a gravel surfaced road. Recreation development consists of a 15 site Transportation campground with a sand beach, boat launch and

a small commercial resort (Bonanza Beach) with two rental cabins and 10 commercial camping sites. The resort provides rowboat rentals.

The lake is well known locally as an excellent fishing lake with catches of good-sized northern pike. In September and October, hunters are attracted to the lake for duck hunting.

There are three permanent residences presently on the lake shore with the surrounding land use remaining in agriculture. The resort owner is currently in the process of subdividing a 20 acre parcel for development of cottages and/or permanent residential lots.

The campground statistics from Alberta Transportation (Table 3) indicate that use has been increasing with a 12% increase in the number of campers during the period from 1977 (5 120) to 1979 (5 760). The resort owner concurs with this growth rate stating that on long weekends, both campgrounds are generally full. The use of the two commercial cabins has been declining in recent years with only about 70% occupancy in July and August and weekends in May and June. This may be due to the rather rustic appearance of the facility.

The lake is also well used by local residents who utilize the Transportation campground facility for swimming and boat launching and the lake for fishing.

The total estimated use for the lake by the various types of users for the summer of 1981 is approximately 7 280 user days. The Transportation campground accounts for the largest proportion (84% - 6 105 user days) followed by day use from local residents (10% - 750 user days), commercial cabin guests (5% - 325 user days), and commercial campground guests (±1% - 100 user days).

A breakdown of the activity occasions on the lake is identified in Table 9.

Table 9
Estimated Number of Activity Occasions for Manatokan Lake

Activity	Activity Occasions	Estimated Proportion of User Days
Fishing	6 552	90%
Swimming	6 552	90%
Camping	6 250	actual count
Sightseeing/Relaxation	5 460	75%
Power Boating	2 184	30%
Nature Study	728	10%
Canoeing	728	10%
Picnicking	364	5%
Water Skiing	364	5%
	29 182	

2.3.7 May Lake

May Lake is located north of Marie Lake and immediately south of the Primrose Lake Air Weapons Range. At the present time, access is limited to float planes and a difficult trail by 4-wheel drive vehicles (approximately 13 km). May Lake is classified as a trophy fishing lake for northern pike which generally indicates that it primarily attracts sports fishermen. To date, no recreation facilities have been developed at the lake, although an informal camping area has been established after years of use by fishermen at a site where the access trail meets the lake. According to CLI recreation capability maps, the lake has potential for the development of cottages and has beaches on the east shore that could support various water-based activities.

Based on discussions with local residents, Alberta Fish and Wildlife officials, and the local game and fish association, it is estimated that there are 200 user days spent on the lake annually. Due to the restricted access and the lake's classification as a trophy fishing lake, the user day estimates are assumed to consist of fishing and camping associated with the fishing experience. This amounts to a total of approximately 400 activity occasions annually.

2.3.8 Tucker Lake

Tucker Lake is located approximately 40 km northwest of the Town of Cold Lake, almost immediately adjacent to Moore Lake. The lake is fed by

Jackfish Creek which flows from the north out of Bourque Lake. The lake area is approximately 630 ha in area with an average depth of 3 m.

Access to the lake is very poor and has been a major factor limiting recreation use of the lake. The outlet of Jackfish Creek at the west end of Tucker Lake is located approximately 11.3 km north of Highway No. 55. Although the lake has not been developed by either the public or private sectors, the generally high backshore and irregular shoreline make it attractive for a wide range of uses. Previous secchi disk readings (3 m) taken for the lake are comparable to other more developed lakes in the immediate vicinity.

Based on discussions with parks officials, local residents, and field observations, it is estimated that the primary use of the lake is for sport fishing which occurs in the spring and early summer. Some swimming and camping also occur during this period in association with the fishing activities. Based on the observations noted, it is estimated that the lake receives approximately 150 user days annually.

Table 10
Estimated Number of Activity Occasions for Tucker Lake

Activity	Activity Occasions	Estimated Proportion of User Days
Fishing	135	90%
Swimming	60	40%
Camping	38	25%
Picnicking	38	25%
	271	

2.3.9 Ethel Lake

Ethel Lake is located about 24 km northwest of Grand Centre via paved and improved gravel roads. The lake has a surface area of 480 ha and a shoreline length of about 10 km. The shoreline of the lake is irregular producing the appearance of four individual bays. Ethel Lake is one of the deeper lakes in the study area with an average depth of 6.6 m and maximum depth of 31 m, and is presently commercially fished for whitefish, walleye, pike, tullibee and ling.

Development on Ethel Lake is varied consisting of permanent residences, cottages, a Recreation and Parks campground and day use area (recently transferred from Alberta Transportation), Girl Guides and Boy Scouts of Canada campsites and a recreation lease by the St. Thomas Acquina Parish Parents and Teachers Association. In order to determine the type and amount of recreation activity occurring on the lake, a variety of information sources have been consulted. The most recent and comprehensive information developed is the "Ethel Lake Management Plan" prepared by Alberta Municipal Affairs in 1980.

Table 11 indicates the estimated number of user days for Ethel Lake as prepared by Alberta Municipal Affairs.

Table 11
Ethel Lake Total User Days

User	Estimated Recreation User Days
Permanent Residents	610[11]
Seasonal Cottagers	2 052
Recreation and Parks	3 063
Girl Guide Camp	704
Boy Scout Camp	2 030
Total User Days	8 459

As noted in Table 11, most of the use occurs by three groups, namely; the cottagers, campers at the Recreation and Parks campground and the Boy Scouts. The lake management plan indicates that use by permanent residents located at or in close proximity to the lake is relatively small, as is the amount of day use.

In order to determine the participation rates of the various recreation activities, use has been made of the Ethel Lake Management Plan as well as on-site observations and discussions with government officials. The Management Plan stated that the main water related activities of permanent residents, in a descending order of importance are picnicking, fishing and swimming. Boating for pleasure, water skiing, and canoeing were also found to be popular summer oriented activities by the permanent residents.

(11) Calculation based upon 15% of potential user days between May 24 to September 10 (110 days).

Although detailed investigations were not carried out by Municipal Affairs regarding use patterns of cottagers, it has been assumed that they would be similar to cottagers on other lakes in the study area.

At the Recreation and Parks campground, the popular activities are fishing, swimming and camping. The activities of boating for pleasure, swimming and relaxation increase in importance during the months of July and August.

At the Boy Scout and Girl Guide camps, a greater variety of activities may be expected. A review of the recreation programming at these camps indicates that camping/hiking (both along the shoreline and back country), nature study, picnicking, swimming and canoeing are the main activities. Since the activities are typically organized for all residents of the camps, there is a relatively uniform use pattern.

Comments received by Alberta Municipal Affairs officials while preparing the lake management plan indicated that the Recreation and Parks campground was fully occupied during most weekends. Further, many of the people feel the lake is over used on long weekends with growing conflicts between the types of boats on the lake, and conflicts between public users and cottagers.

Table 12
Estimated Number of Activity Occasions for Ethel Lake

Activity	Activity Occasions[12]
Swimming	7 866
Fishing	7 189
Camping	6 888
Sightseeing/Relaxation	5 244
Power Boating	4 734
Water Skiing	2 913
Canoeing	2 018
Nature Study	1 437
Picnicking	1 209
Sailing	372
	39 870

(12) Calculations based on 8 459 user days and estimated proportions of user days from Muriel Lake, Section 2.3.2.

2.3.10 Marie Lake

This lake is located about 26 km north of the Town of Cold Lake, just west of English Bay on Cold Lake. Development is limited to the southeast shore. It consists of the permanent CFB tent and trailer camp and a private cottage development. The lake has about 3 400 ha of water surface and 29 km of shoreline and supports a limited commercial fishery. Access to Marie Lake is by a gravel road from the Town of Cold Lake.

The permanent CFB facility provides recreation opportunities for the military personnel at the Base in Medley. The area accommodates 104 campsites usable by either a trailer or a tent. An overflow area is utilized in a field adjacent to the formal campground for peak periods. Other site developments include a boat launch, swimming beach, a camp store and a shower building. The campground operator estimates an average seasonal occupancy at about 80%. The area experiences three distinct use periods. The weekdays experience light usage and the weekends are generally more heavily used. These periods represent an average occupancy of about 50%. The CFB has a block leave period consisting of three weeks from mid July through the first week of August. During this time, the Base provides only essential services and the employees and military personnel are given a holiday. The campground at Marie Lake experiences over 100% occupancy during this period with the overflow area absorbing the excess. The annual use attributable to the CFB campground amounts to 9 984 using a 120 day season.

The cottage use consists of 56 lots in a Crown land subdivision and 11 individual sites scattered around the lake. A total of 66 housing units (either cottages or trailers) are developed, and only one lot remains undeveloped. The Marie Lake Cottage Owner Survey conducted by Alberta Municipal Affairs in 1979 indicates that each cottage generated an average of 0.60 person years of age. This translates to 219 annual user days per cottage, or 14 454 annual user days accountable to all trailers and cottages.

User patterns for cottagers (as shown in Table 2) were determined from the 1979 survey. As no information is available concerning user patterns in the CFB campground, the assumption is made that, considering the similarities in visitor type, use patterns would be similar. The only

exception is the camping percentage. Here, the percentage is weighted due to the campground/cottage disparity and is estimated to be 43.5%. Table 13 provides the activity occasion breakdown for the total 24 438 user days using percentages from the Cottage Owner Survey except as noted.

Table 13
Estimated Number of Activity Occasions for Marie Lake

Activity	Activity Occasions[13]
Swimming	28 949
Fishing	21 505
Sightseeing/Relaxation	19 306
Power Boating	15 151
Canoeing	14 662
Water Skiing	14 418
Hiking	13 440
Photography	12 707
Picnicking	10 997
Camping	10 645
Nature Study	8 064
Sailing	7 087
	176 931

2.3.11 Reita Lake

Located in close proximity to Secondary Highway 897, about 40 km southeast of Bonnyville, Reita Lake has very poor access to its shoreline. The trail into the lake crosses several minor watercourses with access gained only on foot or possibly by 4-wheel drive vehicles.

The lake is very shallow and is heavily infested with emergent and submergent vegetation. The shallow offshore slope and organic bottom materials contribute to the well established weed beds surrounding the shoreline. The total area of the lake is 1 175 ha and it has a shoreline length of 19.6 km. According to CLI recreation mapping, 76% of the shoreline is Class 5 with 19% in Class 4 and the remaining 5% in Class 3. In contrast to the active recreation use of the other study lakes, the potential of this lake and surrounding lands is more toward waterfowl and ungulate production. The lake does support a limited commercial fishery.

(13) Proportions of user days from Table 2 used to calculate activity occasions, except camping.

As a result of the poor access and limited potential for water-based recreation activities, visitor use of the area is very limited. From discussions with local residents and provincial officials, it is concluded that the small amount of use that occurs annually consists almost entirely of waterfowl hunting. No facilites are provided for any activity by the private or public sector and no cottages exist at the lake.

2.3.12 Inaccessible Lakes

Two of the study lakes - Burnt and Caribou Lakes - are located in the Primrose Lake Air Weapons Range along the north portion of the study area. This range is utilized by Canadian Forces and NATO forces for pilot training on a year round basis.

As a result, public access is permitted only on a limited basis when exercises are not occurring and must be authorized in advance. Access is strictly fly-in service as no roads have been developed in the area. Use of these two lakes for recreation purposes consists of fishing and camping in undeveloped areas. As a result of the restricted access and remoteness of these lakes, existing recreation use is very low and not considered significant in the overall study area.

A review was made of the two lakes in terms of their potential development for recreation purposes should this area ever become open to the public for development. Approximately 2.6 km (20%) of shoreline on Burnt Lake are capable of supporting cottage, day use and camping opportunities. Under any development scheme, the remainder of the shoreline would be left in its natural state due to low lying backshore and marshy conditions. Should the area be accessed by road, the lake could potentially receive use pressures similar to that at Manatokan and possibly Ethel Lake. Without road access, it is unlikely that significant public recreation or cottage development would occur and use levels would remain low.

Caribou in contrast to Burnt Lake has a shallow depth and a low capability for water-based recreation activities. Further, the lake has extensive shallow areas with a low lying shoreline eliminating much of the lake for cottage, resort or campground developments. There are, however, certain limited areas along the northwest shoreline and again at the mouth of the Sand River that are capable of supporting some permanent development. These areas total approximately 1.4 km (11%) of the shoreline.

Because of the remoteness of this lake in respect to other lakes with high recreation potential, it is unlikely that it will ever have road access. Consequently, should cottages ever be permitted, both the number of cottages and subsequent use would probably remain low.

2.3.13 Other Watershed Lakes

The lakes discussed in the preceeding sections are those lakes within the study area identified by Alberta Environment that could be utilized as sources of water or for storage of water, for the development currently being considered for the area. Viewing all of the recreation opportunities in the study area as a system, other recreation lakes not specifically targeted for possible water utilization should be identified and discussed.

The lakes within the study area that presently support significant recreation use which have no water utilization potential associated with this development include Moore, Hilda and Ernestina Lakes. These lakes offer the full range of recreation opportunities available at other lakes in the study area.

Moore Lake is the largest of these lakes, providing 948 ha of surface and 16.7 km of shoreline. Current development includes two private resorts which offer boat rental, boat launch, food service and overnight accommodations, two Recreation and Parks campgrounds, and 94 registered lots with 47 cottages. The lake is located 4 km off Highway No. 55, about 28 km west of the Town of Cold Lake.

Hilda Lake is located just east of Moore Lake, about 8 km off Highway No. 55 and 20 km from the Town of Cold Lake. This lake is smaller than Moore, providing 440 ha of surface and 11.6 km of shoreline. The only facility is a private campground providing 15 unserviced sites.

Ernestina Lake has two public campgrounds under the jurisdiction of Alberta Transportation and the M.D. with 30 and 5 campsites respectively. A boat launch is located in the Transportation campground and beaches are present at both areas. This lake is located about 20 km east of Bonnyville off Highway No. 659 and has 363 ha of surface and 7.6 km of shoreline.

These three lakes, though not large in size or extensive in development, could offer opportunities for future development to mitigate any adverse impacts associated with the other study area lakes. No detailed estimate of use was undertaken for these lakes although from the agencies managing the facilities it has been indicated that they are typical of the region.

2.3.14 River Systems

2.3.14.1 Introduction

The recreation use of the rivers and creeks of the Cold Lake - Beaver River area is primarily for canoeing with a limited amount of fishing also occurring. It is the objective of this section of the report to identify the amount of recreation use of the river (quantified where possible) and to determine how the characteristics of the water regime effect the recreation use of the river.

To date, no statistical data has been developed on the recreation use of any of the rivers in the study area. Further, only a few rivers are gauged and therefore, stream flow and water level data are limited. Hence, this analysis is based upon the information from personal interviews with local canoeists in the region such as members of the Kanosoo Canoe Club and representatives of outdoor education/physical education courses.(14)* In addition, two reports were reviewed which provided brief descriptions of the river and anticipated experiences and provided qualitative interpretation of the effects of the water regime on the recreation use of the river.(15)

Table 14 is a summary of the characteristics and canoe use of the rivers identified in the terms of reference, an estimate of existing recreation use, and a qualitative statement of limiting factors to recreation use of the river. To assist in the interpretation of this table, the following brief analysis has been developed for those rivers with canoeing potential.

Based upon the analysis, the rivers have been categorized into three broad groups in terms of their use for canoeing (i.e. high to moderate, moderate to low, and low to nil recreation use). In all instances, canoeing occurs in the direction of the flow of the river.

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* River system footnotes appear at the end of this chapter.

2.3.14.2 High to Moderate Recreation Use

The three rivers which receive high canoe use during the spring and during periods of high water levels are: the Wolf River, the Sand River between the confluence of Wolf River and the Beaver River confluence, and the Beaver River from the Goodridge Bridge to the Alberta - Saskatchewan border.

Wolf River -- The one day excursion on the Wolf River from Wolf Lake to the Sand River is very popular during the high spring flow conditions. Recreation use is estimated to be heavy to moderate, in the order of 40 - 55 user days in a one month period. The Bonnyville High School annually organizes a group tour of about 15 - 20 people. Approximately 10 - 15 canoeists from the Kanosoo Canoe Club in the Town of Cold Lake and about 15 - 20 other casual users are estimated to canoe the river during this period. A limiting factor to canoeing the Wolf River is the low water levels experienced during low precipitation periods in mid to late summer. Periods of high water levels generally occur from the third week in May to mid June. There are no stream flow records for the Wolf River and therefore, one cannot determine the water level for ideal canoeing conditions. Further, it is equally difficult to estimate the length of time when all or parts of the watercourse are suitable, marginal or not suitable for canoeing.

Sand River I -- (Confluence with Wolf River to Truman Bridge.) This portion of the Sand River takes between 1 and 2 days travel time and is classed as a Grade I river in terms of its difficulty. It annually receives heavy to moderate use (20 - 40 user days) similar to Wolf River since there are no access points on the Sand River upstream from the Truman Bridge. The river meanders within a wide valley and low water levels do not appear to be a major constraint to its use.

Sand River II -- (Truman Bridge to confluence with Beaver River.) This portion of the Sand River is classified as Grade II and takes approximately half to a full day to paddle. It is the most heavily used river, or portion of river, within the region. Interviewees have indicated that this portion of the Sand River experiences up to three times the use of the upstream portion[16] (60 to 120 user days) because of its easy access and potential to provide a complete canoeing experience.

The Kanosoo Canoe Club sponsors annual races (2 persons/canoe and at least 15 canoes in each of the four categories) during the spring. The estimated annual use of the river by destination canoeists is approximately 10 - 20 user days.

Due to the extensive rapids in this portion of the Sand River, its recreation use is very much dependent upon the water level. Based upon past recreation use of the river,[17] a discharge of 429 cfs (May 1973) was considered unnavigatable, whereas, very high peak discharges of 4 490 cfs (May 1974) were considered dangerous. There is inadequate data on water flow to accurately define the preferred water flows for this stretch of the river.

Beaver River -- (Goodridge Bridge [Highway No. 881] to the Beaver Crossing.) This portion of the Beaver River receives a high to moderate recreation use from canoeists both during the spring and throughout the summer season. The two to three day trip is classed as Grade I with a few Grade I - II rapids. Recreation use of the river is estimated to be between 100 to 180 user days per year. Lakeland College and the Bonnyville High School both conduct classes or courses on the river. These outings generally include 10 canoes and are held at least once a year.

Based upon the description of the canoe trip in the Reach Reports, the river is navigable throughout the summer since the watercourse is slow moving with no rapids downstream of the Sand River confluence.

This portion of the Beaver River has the greatest potential for shore fishing of all the rivers according to Fish and Wildlife staff, but the extent of existing fishing use is not known.

2.3.14.3 Moderate to Low Recreation Use

Under the second category, there are three rivers which receive moderate to low recreation use. These include: Marie Creek from Ethel Lake to the Beaver River, Mooselake River and the Martineau River from the Primrose Lake Air Weapons Range to Cold Lake. Each of these rivers receive an estimated 10 - 15 user days per season of canoe use. The major constraints are the narrow watercourse, limited access, deadfall and the

Canoe Use

LEVEL OF RECREATION USE	RIVER	PORTION OF RIVER	CLASSIFICATION OF DIFFICULTY	TYPE OF EXPERIENCE
High to Moderate	Wolf River	Wolf Lake to Sand River	II [1]	wilderness – flatwater with some rapids
High to Moderate	Sand River I	Wolf River to Truman Bridge	I [1]	wilderness - flatwater
High	Sand River II	Truman Bridge to Beaver River	II [1]	recreation - Grade II rapids
High	Beaver River	Goodridge to Beaver Crossing	I [1]	recreation - flatwater, some rapids
Moderate to Low	Marie Creek	Ethel Lake to Beaver River	I [2]	recreation - flatwater, numerous natural and manmade obstacles
Moderate to Low	Moose Lake River	Moose Lake to Beaver River	I [2]	recreation - flatwater with some rock bars narrow fast channel on downstream section
Moderate to Low	Martineau River	from inside Saskatchewan to Cold Lake	II [2]	wilderness - flatwater with two Grade II rapids
Infrequent	Jackfish Creek	Tucker Lake to Beaver River	I [2]	recreation - flatwater with extensive rock bars
Infrequent to Nil	Manatokan Creek	Manatokan Lake to Beaver River	I [3]	recreation - flatwater, very small creek
Infrequent to Nil	Medley Creek	Primrose Weapons Range to Beaver River	I [3]	recreation flatwater, very small creek
Nil	Muriel Creek	Muriel Lake to Beaver River		

SOURCES:
1. Travel Alberta, 1978, Reach Reports of the N Headwaters of the Churchill River System p 2
2. Willy Haras, June 1, 1976, Canoe Beaver Coun Canoe Club. 23 p.
3. Personal intereview with Mr. Robert Hornbroo High School, August 31, 1981, local canoeist.
4. The total user day figure is based upon the canoeists and multipled by the duration of t be best supplemented by a user survey if des
5. Future trends is based upon the opinions of
6. Since there are discharge figures for only t to determine the stream flows which provide

# of Rivers

Table 14

RATION OF IP (DAY)	ESTIMATED RECREATION USE		FUTURE TRENDS [5]	LIMITING FACTORS AFFECTING RECREATION USE [6]
	TYPES OF USERS	TOTAL USER DAYS [4]		
	Group/Club/Course Users (25-35 people) Casual Users (15-20)	40 - 55	+	high depending on water level - best during high water (spring and high precipitation)
- 2	Group/Club/Course Users (25-35) Casual Users (15-20)	40 - 110	+	low to moderate dependence on water level
- 1	Group/Club/Course Users (80-120) Casual Users (10-15) (Destination)	45 - 135	+	high dependence on water level 429 cfs too low 4490 cfs too high
- 3	Group (20-50) Casual Users (30-40)	120 - 270	+	low to moderate dependence on water level
	Casual Users (5-10)	2.5 - 5	0	moderate to high dependence on water level
- 1½	Casual Users (10-15)	10 - 22.5	0	moderate to high dependence on water level
- 3	Casual Users (10-15)	20 - 45	+	moderate to high dependence on water level
	Casual Users (5)	2.5	0	high dependence on water level - used during spring only
	Casual Users (5)	2.5	0	high dependence on water level - maybe used during spring only.
	Casual Users (5)	5.0	0	high dependence on water level - maybe used during spring only
			0	

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Sand and Beaver Rivers, it is not possible
eal canoe use of these other rivers.

limited number of camping sites along the routes. The limited navigable season (spring only) deters all but the locals from using these rivers. It should be mentioned that the Martineau River receives a higher recreation use than the other two rivers because it does provide some Grade II rapids and a faster current.(18) Since there is no data on the stream flow and water levels for these rivers, water levels required for ideal canoe use cannot be determined at this time.

2.3.14.4 Low to Nil Recreation Use

The remaining rivers in the study area, Manatokan Creek, Jackfish Creek, Medley Creek, and Muriel Creek, receive infrequent use to no recreation use. The major constraints to canoeing on these creeks are their low flow and small size, deadfall, limited access, low quality of recreation experience as a result of channelization, and poor water quality.(19) The estimated amount of recreation use for each of those rivers with some recreation potential (Manatokan Creek, Medley Creek and Jackfish Creek), is considered to be approximately 5 user days. Muriel Creek, at this time, is not considered to have any canoeing potential.

2.3.15 Winter Recreation

There is a considerable lack of information regarding the levels of participation in outdoor recreation activities that take place in the study area during the winter season. However, some information about participation rates in winter activities is available from cottage owner surveys. Although undertaken during the summer months, the surveys did provide an indication of the participation levels of cottagers in selected winter activities.

Table 15 lists the participation levels in various winter activities. The most popular activity was relaxation (40%), followed by ice fishing (26%), skating (22%), and cross-country skiing (20%). Also listed is the percentage of cottagers surveyed who used their cottage during the winter (November through April).

Table 15
Winter Recreation Activities
(% Participation)

Activity	Moose Lake	Muriel Lake	Moore Lake	Marie Lake	Average
Hunting	4	N/A	9	21	11
Ice Boating	2	3	N/A	2	2
Ice Fishing	26	10	34	33	26
Skating	N/A	N/A	31	12	22
Snowshoeing	10	N/A	16	26	17
Snowmobiling	13	10	28	14	16
Cross-country Skiing	14	3	31	31	20
Relaxation	N/A	N/A	41	38	40
Cottages Used in Winter	35%	24%	50%	60%	

2.4 Proposed Recreation Developments and Programmes

There are several projects and schemes being considered by both the public and private sectors which will make significant contributions to the size, quality and amount of recreation/tourism opportunities available in the region. The agency offering the prime potential is Alberta Recreation and Parks. This is not surprising considering the high recreation potential of the study area lakes.

The major project that has thus far received considerable study, but little else of a concrete nature, is the proposed Lakeland Provincial Park. The area under study extends from Lac La Biche to Cold Lake and is ideal for park purposes as it has the largest concentration of lakes and some of the finest beaches in the province, and is readily accessible to many Albertans by means of a good road network. In 1972, the Parks Division placed a reservation on the area and a major consultant's study was commissioned to examine the recreation potential within the reserve. By 1976, the focus of attention had narrowed to the Jackson and Pinehurst - Seivert - Touchwood Lake complexes. However, major development potential had also been identified by the consultants for Cold Lake, Marie lake and for Wolf Lake. From discussions with Parks personnel, it is clear that the Division still has long-term plans for acquisition and development, especially for English Bay on Cold Lake, however, these plans have not yet been refined.

Another project that has been initiated is the transfer of key, destination - type Alberta Transportation campgrounds to Recreation and Parks jurisdiction. The heavy use, high recreation capability and importance of these sites to the regional recreation system warrants and requires a better standard of management and maintenance. The campgrounds on Cold Lake were transferred several years ago and the campgrounds on Moose, Muriel, Angling and Ethel Lakes were transferred in early 1982.

The Provincial Parks Division also has several other projects at various stages which will greatly effect recreation usage of Cold and Muriel Lakes. Facilities at Cold Lake Provincial Park are presently being more fully developed. An additional 90 campsites, a group campground and 6 km of hiking/cross-country ski trails were completed in 1981. A nature interpretation plan is also being developed to take advantage of the interesting natural processes occuring in and near the park. Expansion of the park is also being considered in order to acquire and protect the lands and waters between the existing park and French Bay that have a high biotic capability. The Division has also examined English Bay and the North Bay areas as possible development sites due to their high recreation capability. The long-term goal is to develop Cold Lake, and the Provincial Park in particular, as a destination outdoor recreation area with quality facilites and programmes comparable to Meadow Lake Provincial Park in Saskatchewan.

On Muriel Lake, Parks presently has a reserve on the southeast portion of the lake, where considerable informal day use and camping already occurs. Negotiations for the purchase of existing private land holdings on the shoreline portion of the reserve are in progress. The park would eventually contain an intensive use area along the shoreline for beach activities and camping, while the backshore uplands would be used for extensive uses such as hiking and trail riding. The exact facilities, capacities and timing are unknown at this time but will likely not occur for 5 to 10 years. The existing crown land is held in grazing leases and the shoreline road requires realignment by the Department of Transportation.

The Parks Division also has an interest in the Sand and Beaver Rivers. Their high capability for linear activities such as stream fishing, hiking

and canoeing were outlined in the consultant's report on the Lakeland Park. They are unique in the study area because of their important potential fish and wildlife habitats, landforms and hiking and canoeing capabilities. Thus, Parks would like to see them designated and managed as recreation corridors. This is only a concept at this time as there is no such legal designation.

The Alberta Forest Service plans to develop primitive campsites at May Lake, and to upgrade the trails and provide walk-in campsites at Wolf Lake.

The Municipal District (M.D.) has adopted a policy to sell their land holdings near cottage areas and to use the proceeds to develop recreation facilities for the general public. The areas identified for development include provincial lands at Moose and Muriel Lakes that would be leased and developed by the M.D.

As part of the Grand Centre - Bonnyville Regional Tourism Plan, several development concepts were suggested for the southern part of Cold Lake. A ski area in the upland to the southeast of French Bay near the Saskatchewan border is presently being cleared. This is a joint venture of the Canadian Forces Base and the Recreation Development Branch of Recreation and Parks. The initial capacity is expected to be 1 000 skiers per hour using a triple chair lift and about 81 ha of ski slopes. A chalet will be built and snowmaking equipment installed as well. A total investment of about $1 848 500 for a skier capacity of about 450/day is planned for the project which is intended to supplement the existing facilities in the region (Beaver River near Bonnyville, C.F.B. Medley, and Lloydminster).

Travel Alberta is also presently examining the financial and physical feasibility of a four season resort complex in the same general area. Further details are not available at this time, however, it would seem logical that if the project proceeds it could be integrated with other developments such as a marina, golf course and the ski area. It is premature to make any predictions, but developments of this nature will greatly increase the levels of recreation use and the importance of Cold Lake as a recreation resource.(20)

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(20) Recent discussions with Travel Alberta indicate that the complex does not appear to be financially feasible at this time.

Several of the commercial operators in the area lakes have plans for expansion of their facilities. These are of a type that will geneally increase their visitor capacity, broaden their market appeal and improve the experience of their guests. Due to the broad nature of the discussions and reticence of the owners to discuss their plans, actual capacities and the expected timeframe for expansion were vague.

On Moose Lake, the owner of Beacon Beach was considering expansion of his marina services but would not proceed until the go-ahead of the heavy oil projects commenced, thus assuring him of an expanded market.

On Muriel Lake, all three operations were planning to expand. At the Spring Beach Resort, plans are being considered to expand the number of trailer spaces, install showers and underground power. This would be a gradual process as the owner's time and money permits. The owner of Silver Birch Cove has plans for significant expansion although they were being severely curtailed due to the high cost of borrowing. These include more trailer hook-ups and cabins and winterizing all new and existing unwinterized cottages (four are not). Upon his retirement in a few years, his intention was to establish a year-round resort offering cross-country skiing, snowmobiling, ice fishing, skating and a putting green, in addition to present water-based activites. The owner of the Kopala Beach Resort identified the possibility of redesigning the campground and developing trailer stalls with electrical plug-ins.

Frank's Marina on Cold Lake completed a new store two years ago and was considering purchasing more rental boats in the near future if business continues to grow.

For Cold, Moose, Muriel, Marie, Manatokan and Ethel Lakes, the continued expansion of cottaging can be expected. Although these lakes are being studied by the Regional Planning Section of Municipal Affairs and management plans have been or will be prepared, there are still many approved lots that remain to be developed. There appears to be a continuing demand for cottage lots. It is therefore a possibility that private land holdings on these lakes may be subdivided and that there will be pressure for subdivision of Crown Land on lakes such as Marie, and perhaps Tucker and Reita Lakes. Pressures will be intensified with the population growth associated with the heavy oil projects. If the demands

for recreation lots are not satisfied locally then they will, in all probability, be transferred to other areas of the basin further to the west.

2.5 Aggregation and Analysis of Use

To assist in the analysis of the various recreation activities and their importance on each lake, as well as on the system scale, a series of figures and tables is supplied which presents the use patterns by both lake format and by activity. Using these graphics, the most important activities at each lake are clearly visable and the most important lake for each activity is also readily apparent. Several lakes in the study area are not included in this section. May and Tucker Lakes both had 400 or less activity occasions in 1981 making their relative significance low.

2.5.1 Use By Activity

Figure 6 indicates the amount of activity occasions each lake presently provides for each of the activities.

2.5.2 Use By Lake

Figure 7 indicates the overall use for each lake, graphically illustrating the relative amount of use each activity accounts for in the total lake use.

2.5.3 Analysis of Existing Use

The preceding figures provide a visual array of existing use within both the system and the individual lake contexts. As such, the analysis of this information is done in both contexts.

At the broad scale, the lakes in the study area should be viewed as an inter-related system of recreation opportunities. In this regard, an impact on an opportunity at one lake will create an impact of change in use at one or several of the other lakes in the system. From the graphics it is apparent that Moose Lake and Cold Lakes are the most popular lakes in the study area. The most popular activities in the study area are ranked below:

Rank	Activity
1	Swimming
2	Fishing
3	Sightseeing/Relaxation
4	Camping
5	Power Boating
6	Water Skiing
7	Canoeing
8	Picnicking
9	Nature Study
10	Sailing

The use of areas as either overnight destinations or day use varies between lakes. Generally, the majority of the areas are considered destination overnight. The one area exhibiting a strong day use orientation is Cold Lake, while Moose Lake also has a relatively significant amount. The day use at Cold Lake is due primarily to the presence of the Towns of Cold Lake, Grand Centre and Medley in the immediate vicinity. As the campground at the Provincial Park at Cold Lake is expanded, a shift toward the percentage of overnight users in the Alberta portion of the total lake use should occur. The total activity occasions for all of the study area lakes is tabulated in Table 16. On an individual lake basis, swimming and fishing are the top two activities at all of the lakes in the study area, accounting for 37 to 46% of the total use.

Table 16
Total Study Lakes Useage

Lake	Activity Occasions
Moose	973 619
Muriel	186 660
Cold	256 830
Wolf	42 258
Angling	8 170
Manatokan	29 182
May	400
Tucker	271
Ethel	39 870
Marie	171 931
	1 709 191

The intensity of use varies widely between lakes. An indicator of use intensity is a figure known as the use intensity index. This index considers the number of activity occasions, the available water surface and, the relationship of shoreline to water surface.(21) Table 17 lists the Use Intensity Index for each of the eight lakes(22) for which the analysis was conducted.

Table 17
Use Intensity Index

Lake	Intensity Index
Moose	259
Muriel	46
Cold	15
Wolf	17
Angling	37
Manatokan	110
Ethel	177
Marie	85

The concept behind the Intensity Index is the total relationship of existing use to the physical parameters of the lake: the water surface and the shoreline. The meaning of the numerical values can best be interpreted by recreationists' perceptions of use levels as recorded in the cottager surveys for Moose, Muriel, Marie and Ethel Lakes. At Moose and Ethel Lakes, with index values of 259 and 177 respectively, 37% and 33% of the survey respondents felt the lake was over used and none felt it was under used. At the other end of the spectrum, Muriel and Marie Lakes, with index values of 46 and 85, recorded under used responses from 21% and 13% of those surveyed, respectively.

The index could be used to assess the existing levels of use and the potential (or lack of potential) for increased use on selected lakes from a user perception standpoint.

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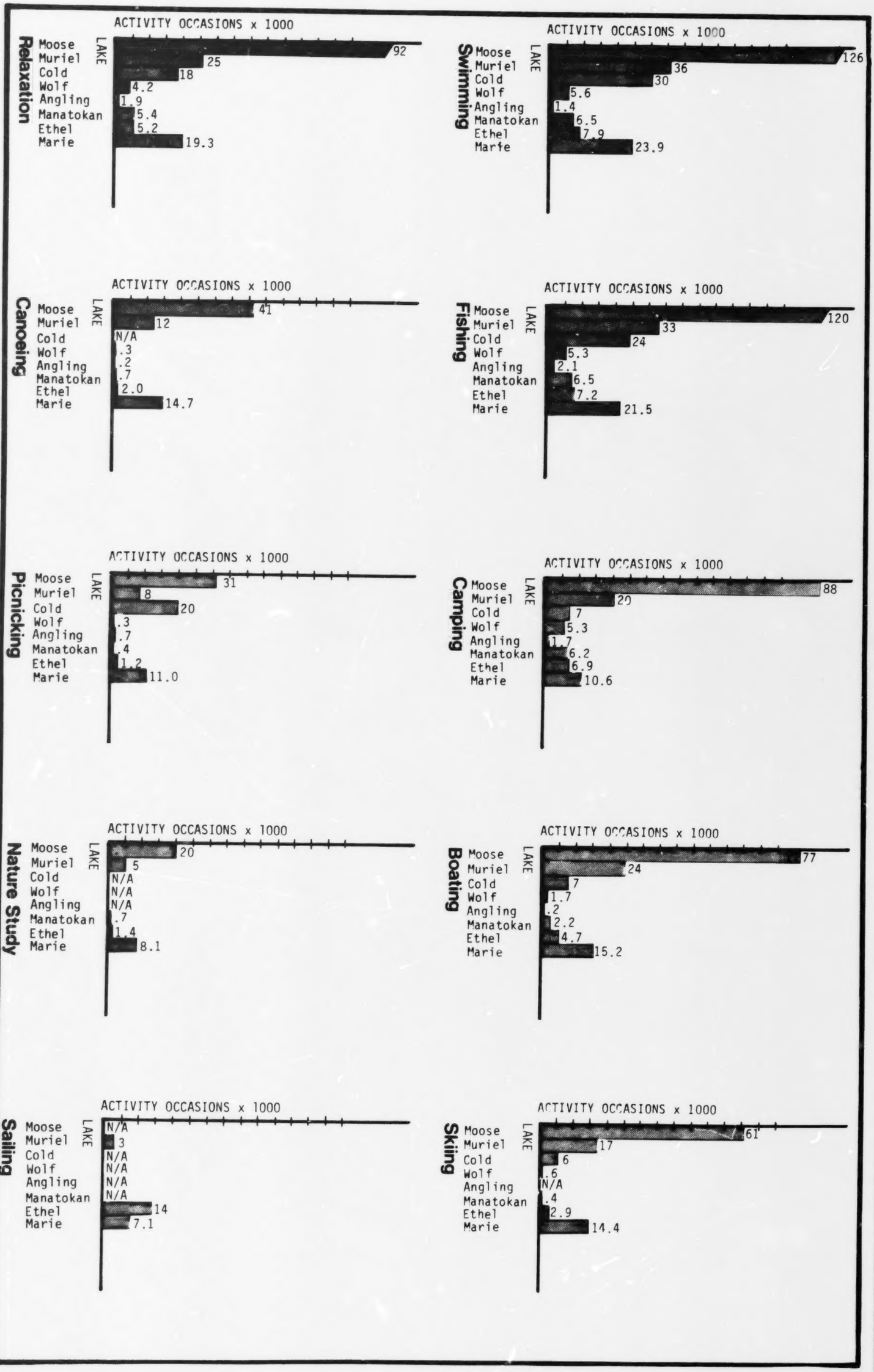
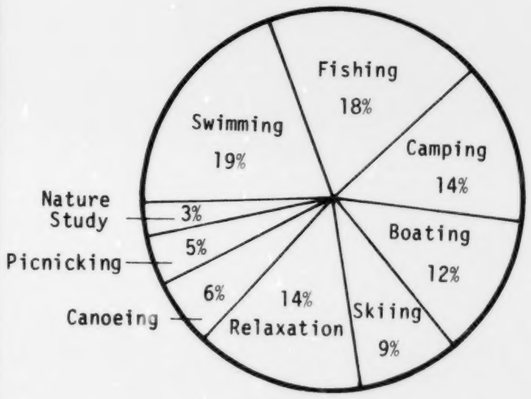
(21) $\text{Index} = \frac{\text{Activity Occasions}}{\text{Water Surface Area}} \times \sqrt{\frac{\text{Water Surface Area}}{\text{Shoreline Length}}}$

(22) Of the other five study lakes, May and Tucker have very low existing use levels which would not provide an accurate value. Reita, Burnt and Caribou do not have use estimates available.

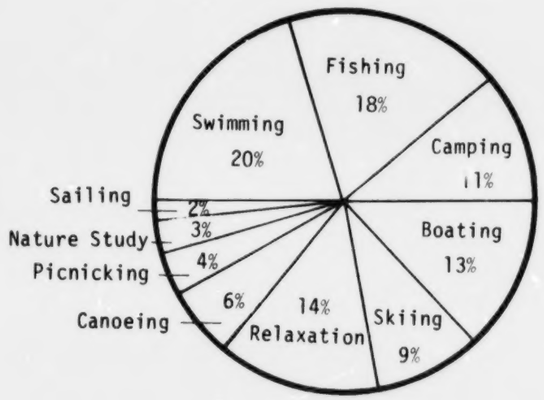


Use by Activity

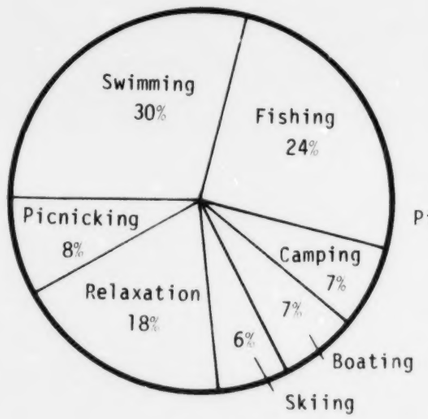
Figure 6



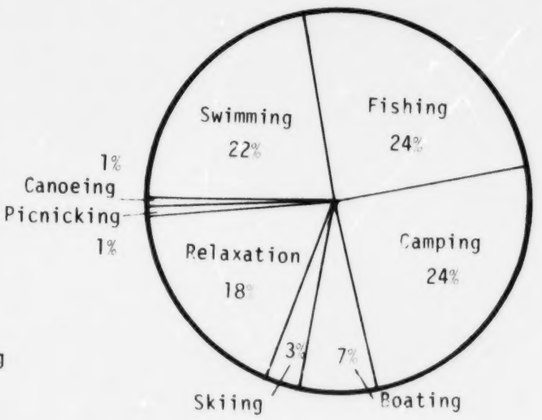
Moose Lake



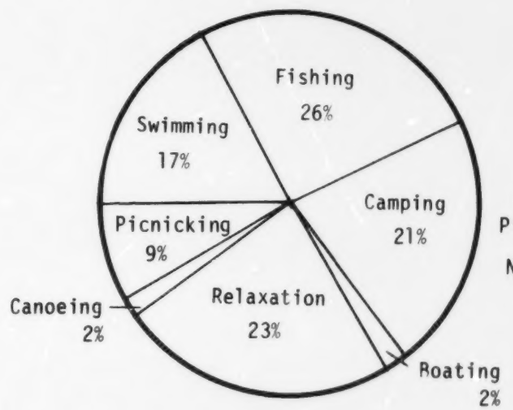
Muriel Lake



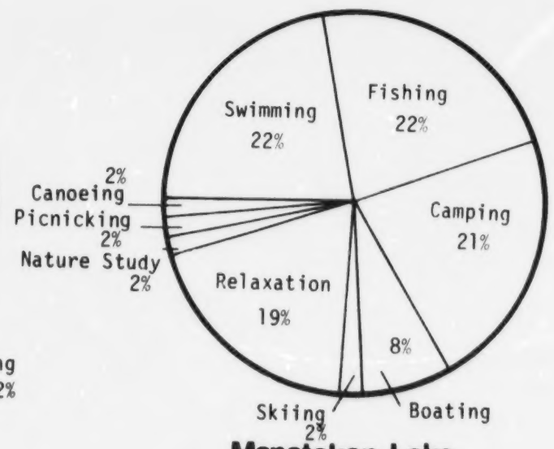
Cold Lake



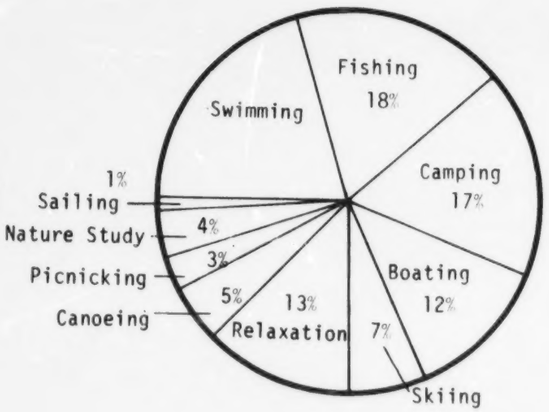
Wolf Lake



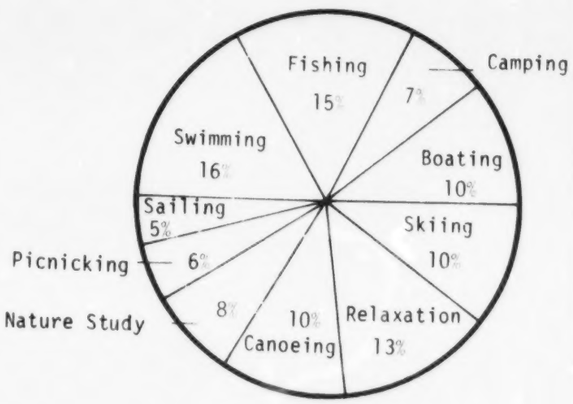
Angling Lake



Manatokan Lake



Ethel Lake



Marie Lake

Use by Lake

Figure 7

Another aspect of visitor use is the origin of recreationists. Results of the cottager surveys for Moose, Moore, Marie and Muriel Lakes represents the only reliable source of information on this aspect. The surveys indicate relatively wide ranges of percentage for each of the three origin categories: Local (0-80 km), Edmonton, and other areas. The average of the four surveys is as follows:

Local	=	51.0% of users
Edmonton	=	35.5%
Other	=	13.5%

The informal survey conducted by the consultant noted approximately the same percentage of Edmonton users, but found fewer local residents and more fitting the "other" category. As the proportion of cottagers and non-cottagers is about equal, the cottages survey should be representative of the actual visitor origin for the study area.

RIVER SYSTEM FOOTNOTES

(14) The following people were contacted regarding the recreational use of the rivers in the region.

1. Mr. Robert Hornbrooke
   Bonnyville, Alberta
   (local canoeist)

2. Mr. Rene Champagne
   Physical Education teacher
   Bonnyville High School
   Bonnyville, Alberta
   (local canoeist)

3. Mr. Rich Le Mieux
   Cold Lake, Alberta
   (member of Kanosoo Canoe Club)

4. Mr. Burt Demeriez
   Outdoor Education Director
   Bennett Centre
   Edmonton, Alberta
   (past resident of Cold Lake and avid canoeist)

5. Mr. Larry Wall
   Operations Planner
   Alberta Recreation and Parks
   Canoeing Instructor
   Edmonton, Alberta

6. Ms. Leslie Kroening
   Edmonton, Alberta
   (member of Alberta Canoe Association)

(15) Travel Alberta, 1978 Reach Reports of the North Saskatchewan River System and Alberta Headwaters of the Churchill River System p. 26 - 32.

Willy Haras, June 1, 1976 Canoe Beaver Country, memoeographic copy of report published by Kanosoo Canoe Club, p. 23.

(16) Robert Hornbrook, personal interview, August 31, 1981.

(17) Travel Alberta, op. cit.

(18) The Matineau River was mentioned by several of the local canoeists as a river with good recreation potential. Mr. Burt Demeriez provided the majority of the information in this report.

(19) Muriel Creek has been channelized at its upper reaches. The recent water quality sampling programme undertaken by MacLaren Plansearch have recorded high counts of nutrients. This low water quality may be one limiting factor the recreation use of Muriel Creek.

3. FUTURE WATER-BASED RECREATION NEEDS

3.1 Introduction

The future water-based recreation needs in the study area are a function of many factors, both internal and external as well as the population and resource base. This section of the report presents several alternative growth scenarios and, on the basis of certain assumptions regarding recreation issues, provides an indication of the implications of these scenarios on future recreation needs. Considering the extensive nature of the recreation use issues, this section can not make hard and fast predictions of future need but can provide general estimates of the future water-based recreation needs in the study area.

3.2 Market Area and Recreation Use Issues

There are significant issues in terms of the market area and recreation use in the study area which could help determine the recreation needs of the area. These issues could include both positive and negative effects on recreation, with both internal and external sources, and are derived from both the population and the resources of the area. The purpose of this section is to identify these topics as potential issues. There is no way of knowing which, if any of these topics could become important, nor is it possible to quantify any impacts which might result.

3.2.1 Cost of Automotive Fuels

This issue is external in source and could greatly effect the future recreation needs. With almost half (49%) of the existing use originating outside the 80 km travel distance, a significant increase in fuel costs could alter the use patterns of the Cold Lake region. Recreationists would seek water-based opportunities closer to home resulting in a decrease of non local use in the study area.

If the availability of fuel remains abundant and the cost remains stable, relative to inflation, no appreciable change in use is anticipated.

3.2.2 Regional Petroleum Development

This resource based issue could be the greatest individual determinant of the future population trends in the study area. Aside from the proposed heavy oil development, other petroleum development in the region will result in a significant increase in population. This increase results partially from oil industry jobs, but also from service industries related to oil, and the general service and supply industry spinoff effect. With a full 51% of the present users originating within 80 km, the use patterns of the study area could shift dramatically with even minor industrial development.

3.2.3 Cottage Lot Subdivision

As cottagers presently account for 44% of the recreation use in the study area, an increase in cottage lot subdivision and development could change not only the activity patterns, but also the overall use patterns. This is evidenced by the cottage surveys which indicated cottagers participate in different activities at different rates and have different frequency and periods of use than non-cottagers. The demand for cottages is evident in the rapid development of lots in the last 5 to 8 years on several of the study area lakes. As available cottage locations closer to Edmonton are utilized, the pressure for cottages in the study area is anticipated to increase dramatically. A factor internal to the study area is the impending petroleum development. The demand for housing in the area will create a demand for cottage lots as permanent residences, as well as the demand for seasonal cottages created by new residents in the local area. The constraint on cottage lot subdivision would appear to be the Lake Management Plans. These plans constitute legal documents that have the authority to designate allowable land uses around the lake, possibly precluding further cottage lot subdivision.

3.2.4 Study Area Recreation Development

Both public and private entities have proposals for expanding recreation opportunities in the study area. These proposals are highlighted in Section 2.4. In addition, the upgrading of existing facilities and opportunities in the area could effect future use. Areas that presently

are over used or are in poor repair, represent a poor recreation experience not conducive to return visits. The future development proposals could effect not only the amount of use in the study area, but the character of use and use patterns.

3.2.5 Central Alberta Recreation Development

This area represents the area outside the study area which serves as an alternative for recreation use to the market areas presently utilizing the Cold Lake - Beaver River region. The recreation opportunities throughout this area constitute competition to the study area. Existing and future public and private opportunities presently effect and will continue to effect, the amount of use in the study area. Such development could include Provincial and other public parks and campgrounds, private campgrounds and resort areas, and cottages and cottage lots.

With present market areas for the Cold Lake - Beaver River region encompassing the Edmonton metropolitan area, the existing 36% of the study area use could be partially diverted to other recreation areas in central Alberta. There are presently about 15 other water-based provincial parks within the same travel time from Edmonton. In addition, several other provincial parks in this same travel time are in various stages of planning. The large number of lakes just west of the study area could constitute significant competition if more fully developed or if better access was provided. Overall, the opportunities available in the study area are not truly unique to central Alberta. With proper development by either public or private entities, these other resources could compete heavily for the non-local segment of the existing users of the study area.

3.2.6 Canadian Forces Base - Medley

The future use of this facility could alter the use patterns of the area and of specific lakes. The CFB campground at Marie Lake accounts for a significant portion of that lake's total use. Also, with the base's proximity to Cold Lake, much of the day use at the beaches and picnic areas in this vicinity could be attributed to the CFB. Consequently, any enlargement or reduction of the base's responsibilities or functions could produce changes in the local use patterns.

3.2.7 Transportation Improvements/Designation

Present access to and through the study area is considered good. From Edmonton, Highway No. 28 serves to provide direct access to Bonnyville and Grand Centre. From the south, Highways No. 36 and No. 41 (Buffalo Trail) are both paved. Travel Alberta has designated Highway No. 28 and No. 41 in the study area as scenic drives. With the petroleum development, traffic on the local routes will greatly increase. Tanker traffic is expected to more than double and other traffic associated with development (i.e. workers, service equipment, etc.) will also increase significantly. The specific routes utilized by this traffic (as well as the times of day) will greatly determine the impact on the recreation users of the area. In regard to the scenic drives, the petroleum development, if not properly planned with consideration for the visual resource, could adversely effect the aesthetics which initially earned the scenic designation.

3.2.8 Area Promotion and Marketing

This could be the most important single issue effecting the future recreation of the study area. The formulation of comprehensive tourism strategy could greatly increase the use of the area. Such a strategy could direct development, as well as promotion, to specific lakes and sites, thereby more effectively utilizing the resources in the area. Travel Alberta is in the process of preparing such a plan. It is currently engaged in the second of four phases with the final phase consisting of implementation of the strategy. Such a strategy could serve to increase the use, alter the use patterns and character of use, and direct the use to the various resources in the study area.

3.2.9 Lake Fishery

Fishing rates second to swimming as the most popular water-based activity in the study area. On many lakes, fishing is the most popular recreation activity and the main reason for travelling to the site. In addition to the generally good fishing at the area lakes, May Lake is identified as a trophy fishing lake. The secondary and tertiary activities associated with the fishing trip make fishing a very large segment of the total area use. As such, the maintenance and improvement of the fishery resources in the area would be a major consideration in determining future recreation

needs. Alberta Energy and Natural Resources will be developing a walleye enhancement programme in the near future. The programme will start with lakes that presently support a walleye fishery, and recommend management alternatives to accomplish the enhancement objective. The Fish and Wildlife Division indicates that Cold, Marie, Ethel, Burnt, Muriel, Moose, Wolf and May Lakes presently support walleye populations and would therefore be elligible for such a programme. Therefore, throughout the entire study area, if fishing is good, visitation is up. Conversely, if fishing is poor, visitation will be lower. The effects of such situations would be felt more acutely at some lakes than others.

3.3 Lake Development Considerations

In looking toward future needs, an analysis of the quality of the recreation experience must be considered. The quality of the recreation experience is a function of many factors. The visitors expectations, the attributes of the site and the visitors perceptions of those attributes all combine to render an experience for the visitor that may be good or bad. With the goal of providing good recreation experiences in the study area, the visitors perceptions should be understood for proper planning. The surveys conducted of the cottagers and the campers provide insight into the visitors perceptions of the areas, including the perception of over use and under use of the area. Over use of the area is utilized as the indicator of a poor recreation experience because of the social and physical impacts associated with over use. This excessive use is also an indicator of popularity relative to the other opportunities in the study area, but the degradation of the experience will still occur. Several mechanisms are available to translate these perceptions into actual planning and management tools which may be used to optimize the recreation experience for the visitor.

3.3.1 Use Intensity Index

This concept was discussed in the previous chapter (Section 2.5.3) as an indicator of the visitors perception of the recreation use of an area as excessive (over used). The concept utilizes a combination of existing use levels with recorded perceptions, lake shoreline, lake surface area, and survey results to produce a numerical index or value. With the upper ends of the index at 259 and 177 representing perceived over use, the optimium

use level can be approximated at 175 for lakes providing a social type of recreation experience, and at 150 for lakes providing a resource-oriented recreation experience. The optimum use level is defined as that level which accommodates the greatest number of recreationists without a loss in the value of the recreation experience. Over crowding and the accompanying problems represents a loss in the value of the experience, while under use would not adversely effect the resource and the inherent quality which represents the value of the experience. This index is based upon seasonal averages and recognizes that the actual visitors perceptions of "crowding" will vary from person to person, weekday to weekend and month to month. This index can be used for planning purposes to determine the unused capability of some lakes and the perceived over use of other lakes. By combining all of the index values for all of the lakes studied, a total capability for the recreation resources of the study area based upon users perceptions can be estimated. Section 3.5 provides this estimate in a comparison of the alternative scenarios.

3.3.2 Management Directed Capacity

This concept relies on the on-the-ground manager to provide information on the optimum use levels with consideration for the number of facilities, quality of these facilites, facility density, capability of the resource, and social factors involved in use of the site. The capacity is determined on a site-by-site basis and is applicable to public and private campgrounds and day use areas. It is understood that the capacity increases with additional facility development, facility upgrading or improved management of the area. It is also understood that this capacity may periodically be exceeded on peak holiday weekends. With the objective of optimizing the recreation experience, it is the responsibility of the management to institute various prescriptions to accomplish the objective. In the course of the expansion of recreation opportunities in the area toward the use levels estimated by the Intensity Index, the Management Directed Capacity can be utilized to ensure the level of use of the available resources which permits the optimum recreation experience.

3.4 Alternative Growth Scenarios

Three alternative growth scenarios will be outlined in this section which should encompass the potential for the study area. The scenarios include:

the baseline, or projection of existing populations without the heavy oil development; a low level of industrial development and the accompanying population increase; and, a high level of industrial development. In order to provide consistency between the various elements of the framework plan for the study area, the population data and two development scenarios were drawn from information provided in the draft "Withdrawal Water Demands, Cold Lake - Beaver River Basin"(1) report.

This report considered the industrial development scenarios for the years 1985, 2000 and 2015 with the largest increase in population attributable to the development occuring between 1985 and 2000. For the purposes of addressing the future water-based recreation needs in the study area, the year 2000 has been utilized as the target year for the needs assessment.

3.4.1 Consideration of Issues

The Market Area and Recreation use issues identified must be considered when projecting future recreation use of the area. With no indication at this point in time of any significant existing or proposed departure from the status quo in any of the issue areas, except petroleum development, a linear relationship between projected population increase and future recreation use levels will be assumed.

3.4.2 Scenario One

This scenario serves as the baseline for comparing the actual increase in population and recreation use attributable to the other scenarios by the projection of existing populations without consideration of the heavy oil development. The existing use patterns and visitor origins will be used for projections of future recreation use.

The market area sectors for the study area have been identified as local (within 80 km), Edmonton metropolitan area, and "other", or those visitors not from either of the first two areas. According to the cottager and camper surveys conducted in the study area, 51% of total use is local in origin, 36% is from the Edmonton area, and the remaining 13% is in the "other" category. The MacLaren report indicates that the population of

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(1) MacLaren Plansearch, September 1981 - subsequently referred to as the MacLaren Report.

the study area - the local market segment - will increase by about 83% between 1981 and 2000. The Edmonton Regional Planning Commission projects a high range increase in the metropolitan area of 62% of the same period. Census Division 10 occupies the area just south of St. Paul and the North Saskatchewan River along the east border of the province. This Division has been selected to represent the "other" category since a significant portion of this category originates there. The projected population increase for this area from 1981 to 2000 is 88%. Based upon these population projections and the known use percentages from each of the market areas, the weighted population increase for the period 1981 to 2000 for the three market area sectors is 75%.

This increase in population, when applied to existing use at 1 709 191 activity occassions, generates a year 2000 use of approximately 2 991 000. Table 18 lists the activity occasions and percentage of total use attributable to each market area sector for each scenario.

3.4.3 Scenario Two

The low industrial development level proposed by the MacLaren Report estimated an additional 3 700 people in the local area, or a 7.6% increase over the local population without heavy oil development in 2000. This converts to a weighted increase in total use of about 4%, assuming non-local growth rate the same as Scenario One. Therefore, in this scenario, total 2000 use would be approximately 3 106 900 activity occasions. This increase in local population would create a minor shift in the overall use patterns.

3.4.4 Scenario Three

This scenario is based upon a high level of industrial development in conjunction with the heavy oil. The MacLaren report estimated a total of 31 800 additional people would reside in the local area due to this level of development. This represents a 66% increase over the projected local baseline population for 2000. An increase of this magnitude in local population would create a shift in the over all use patterns toward a larger proportion of local use. This shift results in 63% of all recreation use in the study area being local in origin. This represents an increase in the year 2000 total use of 34%, amounting to over 4 million activity occasions.

It is not anticipated that the increase in population in the local area in Scenarios Two and Three will result in less of an increase in the population of the remaining market area.

Table 18

Market Area Sector Use Patterns/Demand Projections

(Activity Occasions)

Sector	Scenario 1		Scenario 2		Scenario 3	
Local	1 525 410	(51%)	1 646 660	(53%)	2 525 000	(63%)
Edmonton	1 076 760	(36%)	1 087 400	(35%)	1 082 140	(27%)
Other	388 830	(13%)	372 830	(12%)	400 800	(10%)
Totals	2 991 000	(100%)	3 106 900	(100%)	4 007 940	(100%)

4. WATER-BASED RECREATION ASSESSMENT

4.1 Summary

The purpose of this chapter is to identify the changes in the recreation resources of the study lakes which would result from the alternative water management scenarios, and to describe the water level manipulation potential, if any, based upon the impacts associated with the changes in the resources. Since the study lakes represent a broad diversity of significant resources and levels of recreation use, three levels of assessment were conducted. Assessment levels 1 and 2 are the most detailed and provide an impact assessment table which lists the changes in available resources which would result from the water level alternatives. The assessment tables also indicate the acceptable water level alternatives based upon the changes in the resource. Where mitigation is feasible, management prescriptions are identified which could make a certain water level alternative acceptable. The level 3 assessment provides a narrative description of the general implications to the recreation resources which would result from the water level alternative.

All assessments were conducted utilizing the shoreline descriptions provided by Energy and Natural Resources. The specific elements considered included shoreline length and width, surface and bottom materials, and slope and vegetation for aquatic I, emergent, ice, scour, lake margin, upland bank and upland zones.

During the course of the assessments, some specific use characteristics of the study lakes became apparent. First was the type of use and user of the individual lakes. Some lakes, such as Wolf Lake, are sought by recreationists for an unstructured, low density and primitive type of experience. At the other end of the spectrum was Moose Lake where the whole recreation experience is socially oriented through cottages, resorts and developed parks and campgrounds.

These two distinct use types - resources versus socially oriented - must be accommodated within the study area and the type of use presently experienced at the study lakes was an important factor in the determination of the acceptable fluctuation. The second characteristic, as a corollary to the first, relates to the primary use of some lakes for

fishing. The relationship generally exists that where fishing is the most popular activity, the present use is the unstructured, low density, resource-oriented type. In these situations, any change in the fishery which would result from water level fluctuation would also impact the recreation use of the lake. Consequently, the recommended water level fluctuation for recreation was generally deferred to that fluctuation found acceptable in the fishery assessment.

The conclusions of the assessments indicate that, with the exception of Moose Lake and May Lake, some fluctuation is acceptable on the study lakes from a recreation perspective. The following lists these conclusions for each of the study lakes:

- Moose Lake is not considered as having any fluctation potential. This is due to the intensive use the lake receives and the extensive investment in public and private shoreline development.

- Muriel Lake could accommodate a +0.2 m water level. The resources available at the increased level could support up to seven times the existing use.

- Long Bay on Cold Lake could sustain a +0.2 m water level without compromising the existing recreation facilities or resources. Water levels above the +0.2 m level or below the mean would have adverse affects on the extensive public and private shoreline development of Cold Lake and the fishery in Long Bay.

- Wolf Lake could also be raised to the +0.2 m water level with only insignificant impacts to the recreation resources. This potential fluctuation could positively effect the fishery upon which the existing recreation use is based.

- Ethel Lake could accommodate a +0.2 m and -0.2 m water level. Within this range, the available resources could sustain almost three times the existing recreation use.

- Marie Lake could also accommodate a +0.2 m and -0.2 m water level. Since Marie Lake is presently under-utilized from a recreation standpoint, the resources available within this range could support over four times the existing use.

- Angling Lake could sustain an increase of up to the +0.5 m water level. The expanded boating and fishing opportunities created within this fluctuation range could potentially provide more than eighteen times the existing use.

- Manatokan Lake could also accommodate a +0.5 m water level. The high sand beach and the expanded water surface area within this fluctuation range could sustain almost four times the existing recreation use.

- May Lake, as a trophy fishing lake, is not considered as having any fluctuation potential. Present use is exclusively fishing oriented and water level fluctuations would undoubtedly change the lake characteristics that have created the trophy fishery.

- Tucker Lake could accommodate a +0.5 m water level. Since the fishery is the primary recreation resource of the lake, this acceptable fluctuation corresponds to the recommendation of the fishery assessment.

- Burnt Lake could also sustain a +0.5 m water level in response to the preferred fluctuation for the lake fishery. The location of ths lake within the Primrose Lake Air Weapons Range generally precludes any significant public recreation use other than an occasional fisherman.

- Caribou Lake, also in the Air Weapons Range, could accommodate a +1.0 m water level which also represents the acceptable fluctuation for the enhancement of the fishery.

- Reita Lake's potential fluctuation to the +0.2 m water level also coincides with the preferred fluctuation for the enhancement of the fishery.

The recommended acceptable fluctuations are subject to field verification and should be considered preliminary until such verification of existing shoreline resources and development is done.

When compared against the potential use associated with the "optimum" use of the Use Intensity Index, and the recreation capability of the available

resources identified in the individual late assessments, all of the projected water-based recreation demand of the three alternative growth scenarios could, theoretically, be met by the study lakes as a system.

4.2 Introduction

In this chapter of the report, the impacts of alternative water level fluctuations on the available resources and the existing and potential recreation uses are assessed. As noted in Table 17, the study lakes presently support a wide range of activities and use levels. In addition, they also have different quantity and quality levels of available recreation resources. Consequently, not all lakes would require the same level of impact assessment. In response to this situation, three distinct levels of assessment were identified which ranged from detailed to limited, and are based upon the following criteria.

Level 1 Assessment

This level of impact assessment represents the most comprehensive investigation and is applied only to those lakes which have a high potential for meeting the water requirements of impending development in the study area. These lakes, as identified by Alberta Environment, also include six of the seven lakes most heavily utilized for water-based recreation. The lakes in this level are: Moose Lake, Wolf Lake, Muriel Lake, Ethel Lake, Cold Lake and Marie Lake.

Level 2 Assessment

Lakes in this level are considered as having only moderate potential for meeting future water requirements. They do, however, represent potential for future recreation development and use within the study area. The lakes in this level include: Tucker Lake, Angling Lake, May Lake and Manatokan Lake.

Level 3 Assessment

Due to their location and/or physical characteristics, the lakes in this level have very low potential for meeting regional water requirements.

These lakes also experience very little existing use and have minimal recreation capability. This level of investigation includes the following lakes: Burnt Lake, Caribou Lake and Reita Lake.

The objective of the Level 1 Assessment is fourfold:

1) to identify which of the study lakes could accommodate water level fluctuations by evaluating the recreation capability of each lake at the alternative water levels and assessing the direct impacts of these water levels on the available recreation resource;

2) to identify the degree or amount of fluctuation which could be accommodated by describing an "Acceptable" fluctuation range above and/or below the mean water level at these lakes;

3) to quantify the impacts on the recreation resource and capability associated with this range (point 2 above), in terms of the net gain or loss to the recreation capability; and

4) to identify management practices and mitigation techniques which could be implemented to possibly extend the "Acceptable" fluctuation range.

The Level 2 assessment generally encompasses objectives 1, 2 and 3, but no management practices or mitigative techniques are investigated. The assessment for the Level 3 lakes provides only limited resource assessment and analysis in a qualitative description of the general implications of water level alternatives on the recreation resource.

The following individual lake assessments are supported by tables, figures and maps where appropriate, which allow for a clear comparison of recreation and resource impacts and capability between lakes. To determine the net impacts of any proposed water level fluctations on the recreation resources of the lakes, it is necessary that the existing capability at the mean water level be assessed. The historic mean water level has been used as the basis for the impact assessement of increased or decreased water levels as shown in the Lake Level Impact Assessment Table included for the Level 1 and Level 2 Assessments. Appendix B provides the technical background which describes the detailed process

involved in calculating the areas and activity occasions which are presented in the Lake Level Impact Assessment Tables.

The Summary Ratings given for each alternative water level in the Assessment Table are based upon opportunities and constraints posed by the levels on the existing resources, without consideration for how some of the constraints might be mitigated. It is clearly recognized that some of the constraints are too severe in their intensity or scope to adequately be mitigated to any significant degree. Where mitigation may be feasible, the required prescriptions are identified in the Management Prescription Figure.

4.3 Level 1 Lake Assessments

4.3.1 Moose Lake

A. Recreation Setting and Existing Use

Moose Lake is located in the southwest corner of the study area with the Thinlake River as its source. The lake outflow is into the Mooselake River. The lake shoreline supports extensive public and private development including four commercial facilities, a summer village and other cottage developments, municipal and provincial parks, Alberta Recreation and Parks campgrounds and several institutional camps. Franchere and Island Bays are the only areas on the lake that remain undeveloped. The majority of the shoreline development has occurred in the Bonnyville Beach and Vezeau Bay areas. The provincial park is located along the north central shoreline on the main body of the lake. Access to the shoreline is provided at 11 locations including the cottage areas, the public parks and campgrounds and the commercial and institutional facilities. The accessible and developed portions of the shoreline total 23 km, or about 36% of the total 64.5 km shoreline length. The swimming beaches are located randomly along the shoreline with major concentrations occurring on the east arm and Vezeau Bay areas. Approximately 48% of the shoreline is crown-owned, the majority of which is located in the Island Bay area and along the south side of Franchere Bay. The provincial park on the north shore accounts for about 27% of the Crown shoreline. Both the public and private shorelines have been developed with dock and boat launch facilities. The swimming beach areas and the existing developed

shoreline areas which are evaluated in this assessment, are identified on the shoreline areas map (Map 3) for Moose Lake.

Moose Lake experiences very heavy use during the traditional summer recreation season with intense peaking on weekends. A greater amount of use occurs during the other seasons due to the large number of cottages and the proximity of the lake to Bonnyville.

Swimming is the most popular recreation activity in the summer, followed by fishing, camping and boating. While the great majority of use is overnight, a limited amount of day use does occur in the public and commercial use areas. The cottagers at the lake account for 47% to 67% of the total recreation use. As noted in Section 2.5.3, Moose Lake has a very high Use Intensity Index which indicates that the lake exceeds a maximum utilization level from a visitor perception standpoint.

The present recreation use of Moose Lake is relatively well dispersed along the shoreline with concentrations of sites occurring primarily along the eastern shoreline from Bonnyville Beach Bay to Vezeau Bay. The south and west shorelines are infrequently used due to the extensive low-lying back shore which stretches along much of these areas. All or portions of shoreline segments 1, 2, 3, 4 and 7 (Map 3) are undeveloped, yet accessible, and could support a range of shoreline and upland recreation activities.

Based upon the existing use patterns and levels, it is apparent that Moose Lake provides primarily, a social recreation experience. This is reflected in the high density use which occurs on the available land, shoreline and water surface areas of the lake.

B. Existing Water-Based Recreation Capability

The historic mean water level for Moose Lake is 533.10 m which provides approximately 3 730 ha of water surface area and 1.4 ha of shoreline beach area. The resources available at this mean level are capable of supporting approximately 473 600 water-based activity occasions and a total use - both land and water-based - of 786 240 activity occasions.(1)

(1) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

The estimated existing annual use at Moose Lake is 973 619 activity occasions, which exceeds the potential the resource should support at the mean water level, by about 1.25 times. This information is presented on the Impact Assessment Table (Table 19).

C. Existing Resource Appraisal

As noted in Section A, Moose Lake presently provides a specific type of recreation experience which may be characterized as being very high density and socially oriented. This section identifies those resource characteristics which serve to create the setting for the type of experience desired by the present recreation users of Moose Lake. It is these characteristics that constitute the "attractiveness" of Moose Lake to the recreationist and should be maintained for Moose Lake to continue to provide this type of desired experience.

Beach

- Length: relatively long sections, minimum 1 000 m.
- Width: minimum 1.0 m to be usable, maximum 10 m to still be close to the water.
- Surface Materials: clean sand with few cobbles.
- Aspect: presently all directions - southwest is ideal.
- Location/Access: presently at developed access points in conjunction with other recreation facilities and activities.

Water Surface and Depth

- Usable Area: All of the existing water surface is required to maintain the inherent lake characteristics and to provide the desired range of water surface activities without creating conflicts.

- Depth: for boating activities, a minimum depth of 0.6 m is required.(2)

(2) Motor boats required a minimum of about 1.0 m. Due to the moderate amount of canoe use on Moose Lake, the 0.6 m depth is recommended.

Fishing Success

- o Species: continued catches of whitefish, walleye, pike, and perch.
- o Success Rate: continued moderate success rate.

Visual Quality

- o Erosion along the shoreline not in excess of the existing occurrence.
- o No mud flats or increase in algae.

Shoreline Facilities

- o Usability of private and public boat ramps, docks and other shoreline facilities through the recreation season.

Backshore

- o Vegetative cover consisting of mixed deciduous trees for shade.
- o Presence of understory for site definition and buffering.
- o Developable slope for campsites, picnic sites and support facilities, e.g. washrooms.

D. Comparison of Alternative Water Level Fluctuation Implications

As noted in Section B, the mean water level provides approximately 1.4 ha of shoreline beach. This amount of beach doesn't adequately support the existing swimming use. The +0.2 m lake level results in a decrease in beach area to only 3 040 m^2, which could support only 19% of the existing use. Further water level increases would totally inundate remaining beach areas and possibly flood some cottage lots, while increasing the water surface by up to 24%. The erosion which would occur along the lake shore at these higher levels could cause deterioration of the water quality and the visual quality due to sediment loading and tree fall. In Island Bay, navigability would be improved by higher water levels, and sport fishing opportunities in this area would be enhanced.

Decreased water levels generally would create more beach area while reducing the amount of water surface of the lake. The -0.2 m water level

would create an additional 8.7 ha of beach area but would reduce the water surface area by about 6%. Any further decreases would create great expanses of beach area, and the reduction in water surface area would be most noticable by the loss of Island Bay for recreation opportunities due to its shallowness.

E. Cost Allocation to Recreation with Alternative Water Level Fluctuation

As noted in the Summary Rating column in the Impact Assessment Table, no water level fluctuation from the mean is considered acceptable. These ratings are based in part on the severe impacts that fluctuation would have on the extensive public and private shoreline facilities which are present at the lake. Those facilities which would be impacted include boat launch ramps, permanent docks and even cottages.

The boat launch ramps are generally effected above and below the +0.2 m and -0.2 m water levels. Extending the lower end of the ramps to accommodate decreases in lake levels would not be difficult, but raising the heads of the ramps would be a major task. Most of the permanent docks would be inundated at a +0.5 m lake level and many would be only marginally usable at a +0.2 m lake level. With water level decreases, the -0.2 m water level would not cause significant problems, but a -0.5 m water level change would leave many dock platforms too high to be usable. Water level fluctuations would have the greatest impact on cottages and cottage users. These facilities represent significant capital investment which amplifies the magnitude of any impact. Water level increases could flood some cottages in the low-lying shorelines just north of Bonnyville Beach Bay but the major impact for cottagers would be the shoreline erosion and tree fall which could occur. Water level decreases in cottage areas would further separate the cottage from the waters edge and leave a broad band of decomposing aquatic weeds, cobbles and boulders and/or mudflats. These impacts would create a perceptual or qualitative constraint in addition to the physical constraints imposed.

The ratings are also based upon the severe impacts fluctuations would have on the natural resources of the lake. These resources include the water surface area, the shoreline beach, the upland vegetation and the fishery. The water surface is presently utilized at about 84% of its capability.

(This capability is considered artifically high as it is based upon the inclusion of the surface area of Island Bay which is very shallow). This high utilization indicates that on holiday weekends, the lake surface use possibly exceeds the capability, posing safety problems to boaters. Consequently, any water level decreases would reduce the water surface area and would not be considered acceptable. Although water level decreases would create more beach in some locations, silty bottoms in some existing beach locations would be exposed. Water level decreases would also have drastic negative impacts on the fishery as the shallow areas presently utilized by fish for spawning and rearing habitat would be lost. Since swimming is the most popular water-based activity, water level increases which would reduce the swimming capability would not be acceptable. The fishery may be improved by slight water level increases as additional shallow habitat is created, especially in Island Bay. Increased water levels would also result in increased shoreline erosion and tree fall.

F. Evaluation of Recreation Resource Capability

As noted in Section E, each of the individual resources or facility types could accommodate some limited degree of water level fluctuation. However, the synthesis of these individual elements indicates that not one of the proposed alternative water levels is acceptable to all of the resources and facility types. Consequently, from the recreation perspective, there is no fluctuation potential for Moose Lake. The total recreation resource capability of 786 240 activity occasions is therefore, represented at the historic mean water level.

G. Management Prescriptions

At Moose Lake, the constraints associated with any water level decreases are considered too severe to be mitigated. The +0.5 m and +1.0 m lake levels also pose constraints too severe to be mitigated. However, the +0.2 m lake level does offer limited mitigation potential and these prescriptions are identified in Figure 8. It should be emphasized that this potential is <u>limited</u>, and the feasibility of these mitigative efforts would have to be evaluated by the appropriate agency.

H. Conclusions

Moose Lake should be excluded from further consideration in the water management proposal because of the severe impacts water level fluctuations would have on the recreation resources at the lake. The +0.2 m lake level has limited mitigation potential, but it is felt that overall, the water level in Moose Lake should not be fluctuated to meet the future water needs in the study area.

Lake Level Impact Assessment

Moose Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha / CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha / CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: VEZEAU MD RAMP	FRANCHERE R & P RAMP	PROV. PARK RAMP	PRIVATE DOCKS	VEZEAU RESORT RAMP	NORMAND RESORT RAMP	BEACON BEACH RAMP		WATER SURFACE & SHORELINE ACTIVITY CAPABILITY: ACTIVITY OCCASION (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 534.03	4610		NU	PL	OK	NU	NU	NU	PL		82.1		186.7	50.2	81.6	⊖	400.6	-256.5 / -73.1	594.5	-379.1 / -108.6	NA	. Flooding of some cottage lots . Shoreline erosion
+0.5m 533.53	4170		NU	OK	OK	NU	NU	NU	OK		71.2		168.9	45.5	73.8	⊖	362.4	-293.5 / -111.3	597.8	-439.8 / -162.9	NA	. Beach inundated . Boat ramps & docks not usable
+0.2m 533.23	3006	-1.1 / 0.9	OK	OK	OK	PL	OK	OK	OK		69.5		158.2	42.6	69.1	82.4	371.8	-284.1 / -101.9	551.6	-422.0 / -151.5	NA	. Marginal dock usage . Fishery improved
Current Mean 533.03 — ESTIMATED EXISTING	3730	1.4									122.2		146.2	82.7	133.4	171.4	655.9		979.6			
Current Mean 533.03 — ESTIMATED POTENTIAL											66.4		131.1	40.7	66.0	149.5	473.7		705.1			
-0.2m 532.83	3554	+8.7 / 10.1	PL	PL	NU	PL	PL	PL	PL		63.3		143.9	38.7	62.9	1076.4	1385.2	+729.3 / +911.5	2055.6	+1082 / +1352.5	NA	. Silty bottoms exposed . Marginal dock usage
-0.5m 532.53	3290	+21.4 / 22.8	NU	NU	NU	NU	NU	NU	NU		58.6		133.2	35.9	58.2	2406.0	2711.9	+2056 / +2738.8	4034.5	+3050.9 / +3321.4	NA	. Boat ramps & docks not usable . Fishery impacted
-1.0m 532.03	2860	+42.5 / 43.0	NU	NU	NU	NU	NU	NU	NU		50.7		115.4	31.1	50.4	4673.0	4920.6	+4264.1 / +4446.9	7302.2	+6328.6 / +6580.1	NA	. Decreased water surface area

KEY: OK - NO EFFECT PL - PARTIAL LOSS NU - NOT USABLE

Existing Use Areas

N

SHORELINE AREAS

1. M.D. Campground
   - . beach area inundated at 0.2 m increase
   - . good sand beach with sandy bottom
   - . good upland slope and vegetation
2. Island
   - . beach area inundated at 0.2 m increase
   - . good southern beach exposure
   - . secluded beach opportunities
3. . beach area inundated at 0.2 m increase
   - . good upland slope and vegetation
4. Cottages & Recreation & Parks Campground
   - . silty bottom exposed by decreased levels
   - . private docks impacted by any water level change
   - . marginal swimming beach capability
5. Cottage Area
   - . beach area inundated by increase
   - . private docks impacted by any water level change
   - . cottage lots flooded at
6. Recreation & Parks Campground, M.D. Beach and Cottage Area
   - . silty bottom exposed by decreased levels
   - . private docks impacted by any water level change
   - . beach areas inundated by increase
7. . beach area inundated by increase
   - . good sandy beaches and bottoms
   - . good upland slope and vegetation
8. Moose Lake Provincial Park
   - . launch ramp not effected by increases, not usable with decreases
   - . boat dock impacted by decreases
   - . all beaches except day use area flooded by 0.2 m increase

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1" = 2000'

Moose Lake

Map 3

Management Prescriptions

MOOSE LAKE

LAKE LEVEL	RESOURCE FACILITY OR ACTIVITY IMPACTED WITH MITIGATION POTENTIAL	MANAGEMENT PRESCRIPTION	DEGREE OF MITIGATION
+0.2 m	Shoreline Erosion	Provide vegetative clearing and grading of upland bank along high erosion potential shorelines.	Partial
	Shoreline Beach	Provide vegetative clearing and slope grading along existing beach access shorelines to provide minimum 1.5 m wide sand beach.	Complete

Figure 8

4.3.2 Muriel Lake

A. Recreation Setting and Existing Use

Muriel Lake is located in the south-central portion of the study area, south of the Town of Bonnyville. Access is provided to most of the lake shore by improved roads, including Secondary Highway No. 657 which serves the east and south shores of the lake. Because of the good access, existing recreation development is relatively well dispersed around the lake. The main public facility is the Recreation and Parks campground which is located just north of Gurneyville on the west shore. At the southeast corner of the lake, the Crown Land that presently supports unstructured use is planned for development as a Provincial Park in the future. Cottage sites are located randomly around the lake with the largest subdivision located on the southwest shore.

The greatest amount of recreation use at Muriel Lake occurs during the traditional summer recreation season. At present, the winter recreation use consists of ice fishing and some snowmobiling, but the operator of the Silver Birch Cove resort has plans for future winter operation to include cross-country skiing and ice skating.

Swimming is the most popular summer recreation activity, followed by fishing and power boating. The Recreation and Parks campground presently supports all of these activities and also provides a developed boat launch ramp. The existing use patterns indicate that cottagers comprise an average of approximately 62% of the lake users. The remainder of the lake use is by campers and some day users at the public facilities. On the summer holiday weekends the total lake use is estimated to exceed 1 000 visitors per day. Based upon the user preferences of the cottagers and the existing use patterns, the total summer recreation use in 1981 is estimated at 186 660 activity occasions.

Almost all of the high quality shorelines are presently utilized by some form of recreation development. Map 4 indicates the shoreline areas where water level impacts are discussed.

Based upon the existing recreation use patterns resulting from the high cottage population at Muriel Lake, it is apparent that most of the use is

socially oriented. This is evidenced by the significant amount of cottage use that occurs, and the extensive swimming and boating use that is recorded. Therefore, the resource characteristics which support this type of experience will serve as the basis for evaluating the proposed water level fluctuations.

B. Existing Water Based Recreation Capability

The mean water level for Muriel Lake is 559.47 m which provides approximately 6 413 ha of water surface area and 8.62 ha of shoreline beach. The resources available at this mean level are capable of supporting approximately 1 million water-based activity occasions, with swimming representing over 60% of this capability. The total potential land and water-based use is approximately 1 562 000 activity occassions.(3) The estimated existing annual use of Muriel Lake is 186 660 activity occasions, or about 12% of the existing potential the resource could support at the mean water level.

Muriel Lake offers extensive lengths of wide sand beaches, especially along the southwest shoreline. These beach areas represent significant swimming capability, second only to Cold Lake in the study area. According to the shoreline inventory descriptions, the public use areas which have a sand beach generally have silty bottoms. Other public and cottage shorelines have cobble beaches which restrict both the type and intensity of shoreline activities.

C. Existing Resource Appraisal

As noted in Section A, Muriel Lake presently provides a largely socially-oriented type of recreation experience. This section identifies those resource characteristics which serve to create, and are required to maintain, the setting for the type of experience desired by the present recreation users of Muriel Lake. It is these characteristics that constitute the "attractiveness" of Muriel Lake to the recreationist and should be maintained for Muriel Lake to continue to provide this type of desired experience.

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(3) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

Beach

- Length: relatively long sections, over 1 000 m.
- Width: minimum 1.0 m to be usable, maximum 15 m to still be close to the water.
- Surface Materials: clean sand with few cobbles.
- Aspect: presently northeast and southeast - southwest is ideal.
- Location/Access: presently at developed access areas, boat access beaches offer secluded and/or semi-private experiences.

Water Surface and Depth

- Usable Area: minimum of about two-thirds (4 100 ha) of existing water surface area is required to maintain the inherent lake characteristics and to provide the desired range of water surface activities without conflict.
- Depth: for boating activities, a minimum depth of 0.6 m is required.(4)

Fishing Success

- Species: continued catches of whitefish, perch and pike.
- Success Rate: continued moderate success rate.

Visual Quality

- Erosion along the shoreline not in excess of the existing occurrence.
- No mud flats or increase in algae.

Shoreline Facilities

- Usability of boat ramps and private docks through the recreation season.

---

(4) Power Boats require a minimum of about 1.0 m. Due to the moderate amount of canoe use on Muriel Lake, the 0.6 m depth will be used.

Backshore

- o Vegetative cover consisting of mixed deciduous trees for shade.
- o Presence of understory for site definition and buffering.
- o Developable slope for campsites, picnic sites and support facilities, e.g. washrooms.

D. Comparison of Alternative Water Level Fluctuation Implications

As noted in Section B, the mean water level provides 6 413 ha of water surface area and 8.62 ha of beach area. The capability at this level represents approximately eight times the existing use of the lake.

Water level increases at Muriel Lake would have varying degrees of impact, with the significant impacts occurring at the higher levels and specifically on the shoreline facilities. A +0.2 m lake level would not substantially alter the water surface area or the beach area. The beach areas which remain would still be more than adequate in size, capable of supporting more than ten times the existing swimming use. At the existing beach areas that have silty bottoms, a slight increase would be beneficial by inundating sandy shoreline, creating a better bottom composition for enhanced swimming opportunities. At the +0.5 m lake level, sufficient total beach area still exists, but the distribution of the shoreline segments changes drastically. Only two of the five segments remain at this level, one of which is an existing developed beach. Although the +1.0 m lake level would not inundate these two segments, the capability for swimming would not be sufficient to accommodate any future increased use. The +0.5 and +1.0 m lake level would cause extensive erosion along most of the shoreline, possibly flood some cottage lots and would make most, if not all, public and private shoreline facilities unusable.

Any decrease in the water level would have significant impacts on the existing use, facilities and resources. For some shoreline beach segments, a -0.2 m lake level exposes the silty bottom, creating a muddy margin between the waters edge and the existing sand beach. It is anticipated that over time this new shoreline margin may increase in recreation potential as sand is deposited along the margin. With the generally flat emergent zones along some of the shoreline beach segments,

the -0.2 m lake level would create beaches up to 24 m wide. Further decreases in the water level create substantial additional beach area, but the distance from the upland to the waters edge is excessive, up to 53 m and 103 m for the -0.5 and -1.0 m lake levels respectively. Other impacts associated with decreases would be the exposure of mud flats and aquatic vegetation between the islands and the east shoreline, and in the southeast corner of the lake, also between the island and the shoreline. Depending on the degree and seasonality of these variations and the intensity of ice scouring, these areas may naturally revegetate. In addition, a proportion of the existing public and private shoreline facilities would be lost.

E. Cost Allocation to Recreation With Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment Table indicates the composite rating for each alternative water level. The +0.5 and +1.0 m lake levels are considered unacceptable primarily because of the impacts on the existing public and private shoreline facilities and cottages. Even though sufficient beach area would still be available at both of these increased lake levels to support existing use levels, the spatial distribution is unacceptable.

Should the water level be decreased below the mean, the impacts associated with each of the three alternative water levels would be too severe, and therefore are not acceptable. The most significant impact influencing this rating is the exposure of muddy margins between the water and the upland bank at existing developed beach areas. This would be a serious problem because swimming is the most popular recreation activity at the lake. Another significant impact would be the loss of use of many of the existing public and private shoreline facilities as they would be too far from the shoreline.

The acceptable water level fluctuation range for Muriel Lake would be between the mean water level and the +0.2 m water level. The quantity and quality of the available recreation resources within this range best maintains, and even slightly improves, the recreation value of the lake. It is these values that constitute the "attractiveness" of the lake to the recreation users. The +0.2 m lake level would slightly reduce the beach area to 6.73 ha, and would slightly increase the water surface area to 6 490 ha.

An "Ideal" level for Muriel Lake is difficult to determine due to the limited manipulation potential of the acceptable range. From the perspective of the types of recreation experience desired, the water level which maximizes the quality of the swimming opportunity, yet maintains the usability of the facilities of the existing developed shoreline and beach areas, would be considered the ideal level. Therefore, the ideal level would be toward the upper end of the acceptable range or about 559.60 m. This level would provide:

- Sufficient shoreline beach (7.4 ha), which would provide a higher quality experience, to accommodate more than 14 times the existing use;

- Sufficient usable water surface (6 463 ha) and depth (minimum 0.6 m, average 6.8 m) to sustain more than three times the existing boating use;

- A continued stable bank and shoreline without a large "bathtub ring", or excessive erosion and loss of shoreline vegetation into the lake, thus maintaining the water quality and visual quality of the lake and shoreline; and

- Usable boat launch ramps and shoreline facilities throughout the entire recreation season.

F. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "acceptable" range is 1 562 000 activity occasions at the historic mean water level, and 1 360 000 activity occasions at the +0.2 m lake level. The very large capability at both levels is attributable to the extensive swimming beach area available. Swimming potential accounts for about 35% to 39% of the total capability at these water levels. Even though swimming is the most popular activity at Muriel, such a high amount of future swimming use is highly improbable. The activity that would realistically indiate the lake's capability would be power boating, which represents an estimated 13% of the total land and water recreation use. Since Muriel Lake is presently under-utilized from a recreation perspective, no conflicts would be anticipated between the various activities the lake could support within the acceptable range.

G. Management Prescriptions

The impacts of the +0.5 and +1.0 m lake levels on the existing shoreline facilities and cottage areas are considered too severe to mitigate. The capital investment that these facilities constitute would make any required mitigation prohibitive. For the lower lake levels, the resultant muddy margin along the existing developed shoreline could not feasibly be mitigated. Even at the -0.2 m lake level, 6 100 m^2 of exposed muddy margin would have to be mitigated. At the -0.5 m and -1.0 m lake levels, the existing public and private shoreline facilities would no longer be usable and again, the required mitigation would be prohibitive.

H. Conclusions

The acceptable water level manipulation for the recreation use of Muriel Lake is an increase to the +0.2 m water level. Within this range, the existing use levels and patterns could easily be maintained, and the total resource capability of the increased water level could support up to eight times the current use. The existing beach and shoreline facilities would be the limiting factors in achieving an acceptable range greater than that noted in the Impact Assessment Table. The "Ideal" water level for Muriel Lake is toward the upper end of the acceptable range or about 559.60 m. Since Muriel Lake is presently under-utilized, it offers very significant potential for increased future utilization in meeting the water-based recreation needs in the system.

Lake Level Impact Assessment

Muriel Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha — CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha — CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: SPRING BEACH RAMP	SILVER BIRCH RAMP	KOPALA BEACH RAMP	PRIVATE DOCKS	R & P RAMP				WATER SURFACE & SHORELINE ACTIVITY CAPABILITY: ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 560.47	+386 / 6799	-7.39 / .65	NU	NU	NU	NU	NU				147.2	14.5	94.9	72.4	83.6	44.7	457.3	+337.5 / -543.3	713.4	+526.7 / -848.6	NA	
+0.5m 559.97	+193 / 6606	-5.28 / 3.34	OK	OK	OK	NU	OK				143.0	14.1	92.2	70.4	81.3	237.1	638.1	+518.3 / -363.1	895.4	+808.7 / -566.6	NA	. Shoreline facilities impacted . Erosion
+0.2m 559.67	+77 / 6490	-1.89 / 6.75	OK	OK	OK	OK	OK				140.1	13.8	90.6	69.1	79.8	477.8	871.2	+751.4 / -130.0	1360.0	+1173.3 / -202.0	A	
Current Mean 559.47 — ESTIMATED EXISTING	6413	8.62									25.3	3.4	24.5	12.4	17.3	36.9	119.8		186.7			IDEAL LEVEL = 559.50
Current Mean 559.47 — ESTIMATED POTENTIAL											138.8	13.7	89.5	68.3	78.9	612.0	1001.2		1562.0			
-0.2m 559.27	-77 / 6336	-2.10 / 10.72	PL	PL	PL	OK	PL				137.2	13.5	88.5	67.5	77.9	761.1	1145.7	+1025.9 / +144.5	1787.3	+1600.6 / +285.3	NA	. Silty bottoms exposed . Shoreline facilities impacted . Fishery impacted
-0.5m 558.97	-386 / 6220	-8.38 / 16.95	NU	NU	NU	NU	NU				134.7	13.3	86.8	66.2	76.0	1203.5	1581.0	+1461.2 / +579.8	2466.4	+2279.7 / +909.4	NA	
-1.0m 558.47	-386 / 6027	-18.63 / 27.85	NU	NU	NU	NU	NU				130.5	12.8	84.1	64.2	74.1	1934.8	2300.5	+2180.7 / +1299.5	3588.8	+3402.1 / +2036.8	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE

Existing Use Areas

N

SHORELINE AREAS

1. Recreation and Parks Campground
   - water level increases of more than 0.5 m would inundate beach & flood campground
   - water level decreases would impact boat launch ramp and dock
2. - water level decreases would expose silt bottom
3. Cottage Area
   - beach area on east half usable through 1.0 m increase, west half inundated above 0.2 m
   - private docks impacted by any water level fluctuation
4. - beach area inundated at 0.5 m increase
   - decreases would expose some silt on east end of segment
5. Informal Use Area
   - decreases would expose silty bottoms
   - good slopes, sand beach; and upland
6. Cottage Area
   - beach area inundated by 0.5 m increase
   - private docks impacted by any fluctuation
7. Cottage and Commercial
   - beach area inundated by 0.5 m increase
   - water level decreases would expose silt bottom

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1" = 2000'

Muriel Lake

Map 4

4.3.3 Cold Lake

The impact assessment process for the portion of Cold Lake within Alberta is different than the other lakes due to the limited extent of the shoreline resource descriptions provided by Energy and Natural Resources. These descriptions were provided only for Long Bay on Cold Lake. Consequently, shoreline evaluations for the entire lake could not be prepared. This assessment will therefore, address the recreation resources of Long Bay in specific terms, and the remainder of Cold Lake within Alberta in general terms.

A. Recreation Setting and Existing Use

Cold Lake is the largest of the lakes in the study area. It straddles the Alberta and Saskatchewan border with the majority of the lake in Alberta. Long Bay is a shallow appendage along the south shore of the lake just inside the Alberta border. Public recreation facilities at the lake consist of provincial, town and municipal parks and campgrounds which provide swimming, fishing, boating, and camping opportunities. Cottage subdivisions are located along the west shore just north of the Town of Cold Lake. The Cold Lake Indian Reserve occupies a portion of the shoreline just south of English Bay. No developed public recreation facilities are available on Long Bay although part of the provincial park shoreline is in Long Bay. An informal boat launch area is located on the narrow arm of the bay which extends to the north toward the town. There are also two private residences on the bay, one of which serves as a float plane base.

Access around the lake is relatively good. Improved roads provide access from the town north to the Indian Reserve, and from the south end of English Bay to the northwest end of the lake. Public access is available to Long Bay at the informal boat launch and from the provincial park.

The greatest amount of recreation use at Cold Lake occurs during the traditional summer season. A limited amount of winter recreation use occurs in the form of ice fishing and snowmobiling. Swimming is the most popular summer activity followed by fishing, and sightseeing. The recreation uses are primarily day use oriented due to the close proximity

of the Towns of Cold Lake, Grand Centre, and CFB Medley. These three population centres represent over 10 000 residents all within 10 km of the lake. Furthermore, the communities of Cold Lake and Grand Centre provide tourist type facilities such as motels and concessions for the visitors to the lakes in the area. On Long Bay, boat fishing is the most popular activity although other boating activities also occur. Since no shoreline beach area is available on Long Bay, little if any shoreline recreation activities occur.

As with other lakes in the study area, heavy recreation use of Cold Lake occurs primarily on weekends. The public beach areas in the Town are quite heavily used which provides the large swimming proportion of the total estimated use. The campgrounds are also heavily used on weekends and total use over the last several years is increasing.

The present recreation use of Cold Lake occurs primarily along the south shore near the town, at English Bay and at French Bay. At Long Bay, almost all of the use occurs on the water surface in boating and fishing activities. Map 5 indicates the shoreline segments with existing use or high recreation capability.

Based upon the existing use patterns, the different facilities along the shoreline of Cold Lake provide a variety of recreation experiences. The very large size of the lake readily allows these different types of experiences without conflict between the different types. The public facilities within the Town of Cold Lake provide a high density, socially oriented experience. Long Bay provides a relatively secluded fishing experience that is more resource oriented. Elsewhere around the lake, different types of experiences also occur. The Towns of Cold Lake and Grand Centre depend heavily on recreation use of the lakes in the region to support their tourist facilities. Consequently, any change in the attractiveness of these lakes, and especially Cold Lake, could significantly effect the tourist use of the area.

B. Existing Water-Based Recreation Capability

As noted in the Assessment Table (Table 21), the mean water level is 535.00 m which provides approximately 37 270 ha of water surface area (total - including Alberta and Saskatchewan) and 20 950 m of shoreline

beach (Alberta only). The resources available at this mean level are capable of supporting approximately 3 585 500 water-based activity occasions and total use - land and water-based - of about 5 864 800 activity occasions.(5) The total estimated annual recreation use of Cold Lake is 256 830 activity occasions, or about 4% of the potential the resource could support at the mean water level.

As shoreline resource descriptions are not available from which beach areas could be calculated, the swimming capability is determined by the linear metres of CLI 1-4 shorelines with beach and upland camping or cottaging capability. With water level changes, the beach capability is assumed to remain essentially the same. Variations in capability which might occur at different water levels are not considered significant as the swimming capability at the mean level is so much greater than the existing use.

C. Existing Resource Appraisal

As noted in Section A, Cold Lake presently provides a wide spectrum of recreation experience opportunities, from secluded resource oriented experiences in the small bays at the south end of the lake, to the crowded swimming beaches and the social experience in the Town of Cold Lake. The following characteristics are those that should be maintained for Cold Lake to continue to provide a wide variety of experiences.

Beach

- Length: long, open sections, over 1 000 m.
- Width: minimum 1.0 m to be usable, maximum 10 m to still be close to the water.
- Surface Materials: clean sand with few cobbles.
- Aspect: presently north and east - southwest is ideal.
- Location/Access: presently at developed areas, boat access beaches offer secluded and/or semi-private experiences.

(5) These figures represent an estimate capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

Water Surface and Depth

- o Usable Area: in Long Bay, all of the existing water surface area is required to maintain the inherent characteristics and to provide for a range of water surface activities without creating conflicts.
- o Depth: for boating activities, a minimum depth of 1.0 m is required.

Fishing Success

- o Species: continued catches of trout, whitefish, walleye and pike.
- o Success Rate: continued relatively high success rate.

Visual Quality

- o Erosion along the shoreline not in excess of the existing occurrence.
- o No mud flats or increase in algae.

Shoreline Facilities

- o Usability of the Town pier, private and public boat ramps and private docks through the recreation season.

Backshore

- o Vegetative cover consisting of mixed deciduous trees for shade.
- o Presence of understory for site definition and buffering.
- o Developable slope for campsites, picnic sites and support facilities, e.g. washrooms.

D. Comparison of Alternative Water Level Fluctuation Implications

As noted in Section B, the length of the shoreline with moderate to high CLI beach classification (1-4) has been used to estimate the swimming capability for Cold Lake. Since different shoreline lengths for the alternative water levels are not known, the same capability value for swimming is used for all alternative level assessments on the Impact Assessment Table (Table 21).

The impacts from water level increases on the other resources and facilities other than swimming could be quite significant. The existing shoreline facilities at the public and private development areas would be severely impacted by inundation. Only slight increases in the water surface area would result. In Long Bay, slight increases in the water level would improve navigability and create additional fish habitat. The existing private residences which are located along the shoreline might be flooded by increases over 0.5 m due to the low-lying backshore in these areas. The environmental interpretation area within the provincial park depends on relatively stable water levels to maintain the characteristics being interpreted. Increases over the +0.2 m water level would begin to effect these characteristics and the facilities provided to interpret them.

Decreases in the water level would also impact the existing public and private shoreline development. Since a significant amount of recreation and tourist retail and service income for the area is dependent upon the attractiveness and usability of these shoreline facilities, even minor decreases in the water level would have major implications. From a resource perspective, decreases in water levels would result in a major loss of fish habitat in the Long Bay area. In addition, the recreation use of Long Bay would be reduced because the decrease in depth would further restrict boating activities. The residence on Long Bay which serves as the float plane base would be impacted if the float plane was not able to dock at its present location due to reduced water levels. The environmental interpretation area in Hall's Lagoon would experience deleterious changes if water levels decreased with consequent changes in interpretive programming being unnecessarily imposed.

E. Cost Allocation to Recreation with Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment Table indicates the composite rating for each of the water level alternatives. Even though the gross capability of the shoreline and water surface resources at the mean water level is sufficient to sustain over 25 times the existing use, the impact on the fishery and the existing shoreline facilities will determine the acceptable fluctuation.

If the lake levels are decreased below the historic mean, more beach area will be created as the water surface area is reduced. The resource implications of the -0.2, -0.5 and -1.0 m lake levels have been identified in Section D. The impacts of these implications include: severe boating constraints in Long Bay posed by shallow areas and reduced water surface; the extensive loss of fish spawning and rearing habitat; the significant degradation of the aesthetic quality of the shoreline of the lake, and the affect on the extensive existing shoreline facilities. Also, the environmental interpretation areas and the interpretive programmes of the provincial park would be severely impacted by any water level decreases.

Increases in the water level above +0.5 m, would make the existing shoreline facilities unusable. An acceptable fluctuation would be to the +0.2 m water level. This increase is considered acceptable because it provides:

- sufficient shoreline beach to accommodate swimming activities on the main lake;
- sufficient water surface area and depth in Long Bay to improve navigability and boat access especially near the sand shoal;
- an improved fishery in Long Bay by creating additional habitat;
- a continued stable bank and shoreline without excessive erosion and loss of shoreline vegetation into the lake, thus maintaining the water quality and visual quality of the lake and shoreline;
- usable boat launch ramps throughout the entire recreation season;
- usable dock and pier facilities along the shoreline; and
- a high quality, and possibly improved, environmental interpretation area in the Provincial Park.

An "Ideal" range of water level fluctuation is difficult to determine for Cold Lake due to the limited manipulation potential of the acceptable range. From a recreation and tourism standpoint, the level which provides the optimum utilization and attractiveness of the existing shoreline

facilities would be considered "Ideal". This level therefore, would be at, or slightly above the mean water level, at approximately 535.0 m.

F. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "Acceptable" range is 5 864 800 activity occasions at the historic mean, water level, and 5 875 500 activity occasions at the +0.2 m water level. Since Cold Lake is presently under utilized from a recreation resource perspective, no conflicts would be anticipated between the various activities or experience types which the lake could support within the acceptable range.

G. Management Prescriptions

At Cold Lake, the impact of water level fluctuations on the extensive existing shoreline facilities and the impact on the fishery determined the acceptable fluctuation. Consequently, there would be no feasible mitigation of these impacts for any of these other alternative water levels.

H. Conclusions

The acceptable water level manipulation for the optimum recreation use of Cold Lake is an increase to the +0.2 m water level. Within this range, the existing use levels and patterns could easily be sustained, with a total resource capability of more than 25 times the existing use. This high capability is based upon extensive areas of presently undeveloped quality beach areas (CLI classes 1-4) along the west shore.

The "Ideal" water level would be at or slightly above the mean water level because of the extensive shoreline development. This level would be approximately 535.0 m.

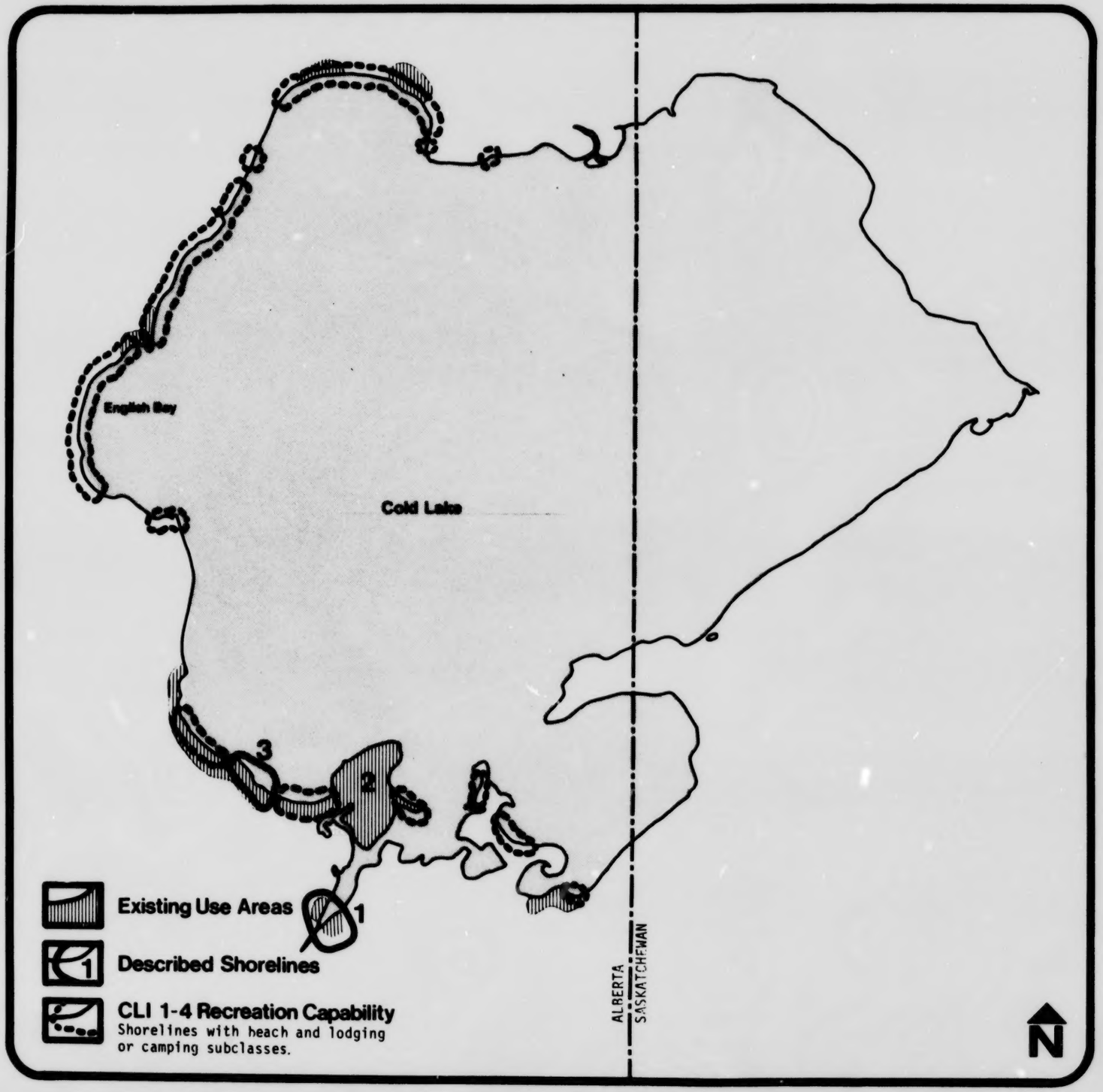
Since Cold Lake is presently under-utilized, it offers very significant potential for increased future utilization in meeting the water-based recreation needs in the study area. This increased utilization would best be realized in development of public facilities on crown land along the west shoreline of the lake.

Lake Level Impact Assessment

Cold Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha — CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha — CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: FRANKS RAMP	PRIVATE RAMPS	PRIVATE DOCKS	R & P RAMP	MD RAMPS				WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 536.00	+581 / 37851		NU	NU	NU	NU	NU				1148.8		643.0		337.0	1487.5	3618.3	+3461.3 / +32.8	5918.3	+5661.5 / +53.5	NA	
+0.5m 535.50	+291 / 37561		NU	OK	NU	OK	OK				1140.0		640.0		334.4	1487.5	3601.9	+3444.9 / +16.4	5875.5	+5618.7 / +10.7	NA	. Shoreline facilities impacted . Environmental Interpretation area impacted
+0.2m 535.80	+116 / 37586		OK	OK	OK	OK	OK				1134.7		637.1		332.9	1487.5	3598.2	+3435.2 / +6.7	5875.5	+5618.7 / +10.7	A	
Current Mean 535.00 — ESTIMATED EXISTING	35270										45.1		19.3		15.4	77.2	157.0		236.8			IDEAL LEVEL = 535.00
Current Mean 535.00 — ESTIMATED POTENTIAL											1131.1		636.1		331.8	14875	3585.5		5864.8			
-0.2m	+116 / 37154		OK	PL	OK	PL	PL				1127.6		633.1		330.8	1487.5	3579.0	+3432.0 / -6.5	5854.1	+5581.2 / -36.6	NA	. Fishery impacted . Shoreline facilities impacted . Environmental Interpretation area impacted
-0.5m	-291 / 36979		NU	NU	NU	NU	NU				1122.3		630.1		329.2	1487.5	3569.1	+3418.1 / -16.4	5811.3	+5554.3 / -59.5	NA	
-1.0m	-581 / 36680		NU	NU	NU	NU	NU				1113.5		625.2		326.6	1487.5	3552.8	+3383.8 / -32.8	5811.3	+5554.3 / -59.5	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



SHORELINE AREAS

1. Existing residences along shoreline including float plane centre
   - . decrease would affect access from water surface
   - . increases above 0.5 m could flood back-shore areas
2. Cold Lake Provicinal Park
   - . Halls Lagoon Environmental Interpretation area impacted by any decreased, might be enhanced by slight increase if no connection with lake is made
3. Town of Cold Lake
   - . marina and private launches impacted by decreased levels
   - . slight increase would not severely impact existing beaches
4. English Bay Recreation and Parks Campground
   - . boat launch impacted by decreased levels
   - . slight increase would not severely impact existing beach

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1"=3000'

Cold Lake

Map 5

4.3.4 Wolf Lake

A. Recreation Setting and Existing Use

Wolf Lake is located in the northeast section of the study area, with the entire shoreline held by the Crown. The only developed facility, an Alberta Forest Service (AFS) Campground is located on the south side of the lake. Access to this site is provided by a gravel road. The 1.5 km of developed shoreline at the campground accounts for only 3% of the total shoreline length. A dirt trail permits shoreline access to the undeveloped use areas on the east shore of the lake. There are no other vehicular access points to the lake. These recreation developments and high recreation capability shorelines are illustrated on Map 6.

The greatest amount of use at Wolf Lake occurs during the traditional recreation season of mid-May to September. A limited amount of fall and winter use occurs as long as the lake is accessible by vehicle.

Sport fishing is the primary activity and the main reason for visiting the lake in the summer. Other popular recreation activities include swimming, picnicking and camping. The AFS Campground presently supports all of these activities. It also includes a boat launch ramp.

On heavy use weekends, camping overflows into the picnic area, and the east shore is subjected to a significant amount of unstructured use. During the summer of 1981, the lake accommodated an estimated 40 to 50 camping parties of three to five individuals on each weekend day. On long holiday weekends, as many as 175 camping parties have been recorded. Weekday use during the summer is considerably less than weekends, with only 15 to 20 camping parties present. Total 1981 summer recreation use is estimated at 42 258 activity occasions. This figure includes about 55 user days attributable to canoeists using the Wolf River for the trip down to the Sand and Beaver Rivers.

The limited fall and winter recreation use consists mainly of moose hunting, snowmobiling and ice fishing. This use occurs almost exclusively on weekends and is subject to the weather and vehicular access to the lake. No use figures are available for winter recreation.

The present use of Wolf Lake occurs in three general locations along the south and east sides. There are, however, other locations along the lake that could support a range of shoreline and upland activities, but present access is restricted to foot or boat.

Based upon the existing use patterns at Wolf Lake, it is apparent that recreationists utilize the area for the rustic qualities inherent in the existing resources. This is reflected in their desire to recreate in an area that is relatively natural - requiring only minimal development and preferring low density camping, good fishing and minimal boat traffic. The desired recreation experience therefore, is to a large extent resource oriented, not socially oriented. The high popularity of sport fishing at the lake represents one type of resource orientation, and consequently, any change in the fishery could significantly effect the overall recreation use of the lake - both summer and winter.

B. Existing Water-Based Recreation Capability

As noted in the Impact Assessment Table (Table 2 2), the mean water level is 597.37 m which provides approximately 3 365 ha of water surface area and 2.0 ha of shoreline beach. The resources available at this mean level are capable of supporting approximately 296 700 water-based activity occasions and total use - land and water-based - of about 582 600 activity occasions.(6) The estimated existing annual recreation use at Wolf Lake is 42 258 activity occasions, or about 7% of the potential the resource could support at the mean water level.

C. Existing Resource Appraisal

As noted in Section A, Wolf Lake presently provides a specific type of recreation experience which is rustic, natural and largely resource oriented. This section identifies those resource characteristics which serve to create the setting for the type of experience desired by the present recreation users of Wolf Lake. It is these characteristics that constitute that "attractiveness" of Wolf Lake to the recreationist. They should be maintained if Wolf Lake is to provide this type of desired experience in the future.

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(6) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

Beach

- Length: relatively short sections, under 1 000 m.
- Width: minimum 1.0 m to be usable, maximum 10 m to still be close to the water while maintaining a small or secluded atmosphere.
- Surface Materials: clean sand with few cobbles.
- Aspect: presently north and west - southwest is ideal.
- Location/Access: presently at terminus of vehicle access, boat access beaches offer secluded and/or semi-private experiences.

Water Surface and Depth

- Usable Area: minimum of about two-thirds (2 000 ha) of existing water surface area is required to maintain the inherent characteristics and to provide for the range water surface activities without conflict.
- Depth: for boating activities, a minimum depth of 1.0 m is required.(7)

Fishing Success

- Species: continued catches of whitefish, walleye and pike.
- Success Rate: continued relatively high success rate.

Visual Quality

- Erosion along the shoreline not in excess of the existing occurrence.
- No mud flats or increase in algae.

Shoreline Facilities

- Usability of boat ramps through recreation season.

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(7) Canoes require a minimum depth of about 0.6 m. Due to the small amount of canoe use on Wolf Lake, the 1.0 m depth will be used.

Backshore

- o Vegetative cover consisting of mixed deciduous trees for shade.
- o Presence of understory for site definition and buffering.
- o Developable slope for campsites, picnic sites and support facilities, e.g. washrooms.

D. Comparison of Alternative Water Level Fluctuation Implications

As noted in Section B, the mean water level provides approximately 2.0 ha of beach area with about 1.4 ha (70%) being existing accessible beach. The +0.2 m water level would inundate about 60% of the existing beach area, but all beach areas could still support swimming and sunbathing activities.

Further increases to the +0.5 m and +1.0 m lake levels totally inundate all beaches and enlarge the water surface area by about 8 to 25% by the linkage of Lane Lake to Wolf Lake at the +1.0 m water level. This linkage may provide additional sport fishing opportunities and fish habitat. The erosion which would occur along the lakeshore at these higher levels could cause deterioration of the water quality as well as the visual quality of the lake due to sediment loading and tree fall along these shorelines.

A -0.2 m lake level creates an additional 1.5 ha of beach area with about the same spatial distribution as at the mean level. Further decreases in the water level provide substantial additional beach area, but two significant implications result from these decreases: the exposure of extensive mudflats at the southwest end and near Lane Lake; and, the -1.0 m lake level will effectively separate the west arm from the main body of the lake by making the passage unnavigable by anything but canoes. The beach and water surface area of this arm would be no longer accessible by motor boats if this separation occurs.

E. Cost Allocation to Recreation with Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment Table indicates the composite rating for each water level alternative.

At the +0.2 m lake level, all beach areas are still usable. Since swimming is the second most popular activity at the lake, the remaining beach would make the +0.2 m lake level acceptable. As all of the beach is inundated above this level, the water level will encroach on the upland resource zones where the resultant erosion could be significant resulting in deteriorated water quality and visual quality due to sediment loading and tree fall.

Decreases in the lake level below the mean level, will create more beach area as the water surface area is reduced. The resource implications of -0.2, -0.5 and -1.0 m lake levels have been identified in Section D. The impacts of these implications include: severe boating constraints posed by shallow areas and reduced water surface; the extensive loss of fish spawning and rearing habitat; and, the significant degradation of the aesthetic quality of the shoreline.

The resulting "acceptable" range includes the fluctuation between the mean level and the +0.2 m lake level. The quantity and the quality of the available recreation resources within this range best maintains the present recreation value of the lake. It is these values that constitute the "attractiveness" of the resource to recreation users. The results of the increase are a loss of 1.2 ha of beach and a gain in water surface area of approximately 105 ha.

An "Ideal" range for Wolf Lake is difficult to determine due to the limited manipulation potential of the acceptable range. From a recreation standpoint, the lake level which provides the most productive fishery would be the "Ideal" level. Based upon the fishery assessment, the "Ideal" water level would be toward the upper end of the acceptable range or about 597.55 m. In addition to a productive fishery, this ideal level would provide:

- Sufficent shoreline beach (8 000 m^2 plus) to accommodate more than six times the existing swimming use;

- Sufficient water surface (3 470 ha) and depth (minimum 1.0 m, average 8.6 m) to sustain approximately 13 times the existing boating use;

- o A continued stable bank and shoreline without a large "bathtub ring" or excessive erosion and loss of shoreline vegetation into the lake, thus maintaining the water quality and visual quality of the lake and shoreline; and

- o A usable boat launch ramp throughout the entire recreation season.

F. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "acceptable" range is 582 600 activity occasions at the mean water level, and 424 800 activity occasions at the +0.2 m water level. The slight loss of capability from the mean level is attributable to the loss of swimming beach area. Swimming potential accounts for about 24% of the total capability at the mean level. Since Wolf Lake is primarily a fishing lake, such a high amount of future swimming use is highly improbable. The activity that would realistically indicate the lake's capability would be boat fishing, which represents an estimated 75% of the total fishing use. As Wolf Lake is presently under-utilized from a recreation perspective, no conflicts would be anticipated between the various activities the lake could support within the acceptable range.

G. Management Prescriptions

For the alternative lake levels proposed for Wolf Lake, the +1.0 m water level and -0.2, -0.5 and -1.0 m water levels are considered as having very limited mitigation potential and are therefore, not included in the Management Prescriptions (Figure 9). The +0.5 m water level is the only level considered to have mitigation potential.

The +1.0 m water level not only inundates all existing beaches, but would create excessive erosion, and result in a partial loss of the use of the boat launch ramp. The possibility of shoreline modification in the form of vegetative clearing and slope grading would not seem feasible for a vertical increase of this extent, even though the head of the boat launch ramp could be raised.

The apparent lack of mitigation potential for the decreased levels stems from the impact these levels would have on the fish populations, and the resulting impact on the fishing activity the lake supports - both commercial and recreation.

H. Conclusions

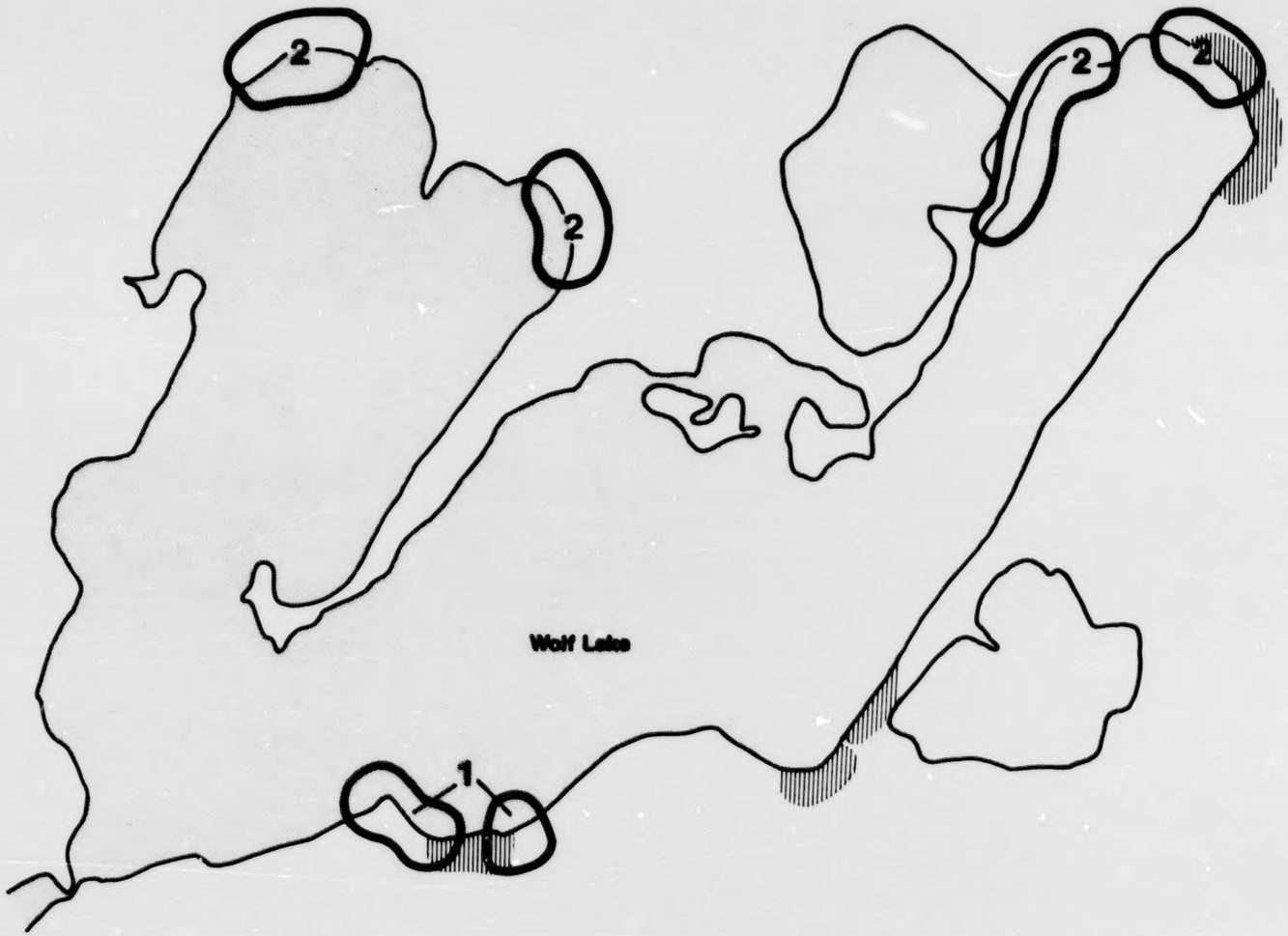
The acceptable water level manipulation for the recreation use of Wolf Lake is to the +0.2 m water level. Within this range, the existing use levels and patterns could easily be sustained. The total resource capability of the lake could sustain about 14 times the current use. The swimming beach area would be the limiting factor in achieving a higher capability level for increases than noted in the Impact Assessment table which created additional beach area through vegetative clearing and slope grading. The "Ideal" water level would be about 597.55 m which is toward the upper end of the acceptable fluctuation range. Since Wolf Lake is presently under-utilized, it offers very significant potential for increased future utilization in meeting the water-based recreation needs in the system.

Lake Level Impact Assessment

Wolf Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha (CHANGE FROM CURRENT / BALANCE)	PHYSICAL RESOURCES: SHORELINE BEACH-ha (CHANGE FROM CURRENT / BALANCE)	PUBLIC & COMMERCIAL SHORELINE FACILITIES: AFS BOAT RAMP								WATER SURFACE & SHORELINE ACTIVITY CAPABILITY: ACTIVITY OCCASIONS (X 1000) BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 598.37	+869 / 4228		NU								100.9		62.5	7.2	14.9		194.5	+179.1 / -102.2	381.7	+339.4 / -300.9	NA	
+0.5m 597.87	+264 / 3629	⊖	PL								94.3		59.6	6.2	12.8		166.9	+145.5 / -129.8	327.6	+285.3 / -255.0	NA	. Beach inundated . Shoreline erosion
+0.2m 597.57	+105 / 3470	-1.2 / .8	OK								90.2		51.3	5.9	12.2	56.8	216.4	+195.0 / -80.3	484.8	+382.5 / -157.8	A	
Current Mean 597.37 — ESTIMATED EXISTING	3365	2.0									7.4		3.1	0.5	1.0	9.4	81.4		42.3			
Current Mean 597.37 — ESTIMATED POTENTIAL											87.5		49.7	5.7	11.8	142.0	296.7		582.6			IDEAL LEVEL = 597.55
-0.2m 597.17	-105 / 3260	+1.5 / 3.5	PL								84.7		48.2	5.6	11.5	248.5	398.5	+377.1 / +101.8	782.3	+740.0 / +492.0	NA	. Fishery impacted . Boat ramp impacted
-0.5m 596.87	-264 / 3101	+1.5 / 5.7	NU								80.6		45.8	5.3	10.9	404.7	547.3	+525.9 / +350.6	1074.6	+1032.3 / +492.0	NA	
-1.0m 596.37	-587 / (2830)	+7.6 / 9.6	NU								52.6		29.9	3.4	7.1	681.6	774.6	+753.2 / +477.9	1584.6	+1552.3 / +1012.0	NA	. West arm of lake not accessible

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



Existing Use Areas

N

SHORELINE AREAS

1. Forest Service Campground
   - . decrease of more than would impact boat launch ramp
   - . increases greater than 0.2 m would inundate beach
2. . increase greater than 0.2 m would inundate beac.
   - . good upland slope and vegetation for recreation development
   - . good sand bottom and southern aspect for swimming

COLD LAKE - BEAVER RIVER

Water - Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1" = 1000'

Wolf Lake

Management Prescriptions

WOLF LAKE

LAKE LEVEL	RESOURCE FACILITY OR ACTIVITY IMPACTED WITH MITIGATION POTENTIAL	MANAGEMENT PRESCRIPTION	DEGREE OF MITIGATION
+ 0.5 m	Shoreline Erosion	Provide vegetative clearing and grading of upland bank along high erosion potential shorelines.	Partial
	Shoreline Beach	Provide vegetative clearing and slope grading along existing beach access shorelines at AFS Campground and northeast corner to create minimum 1.5 m wide beach.	Complete
	Boat Launch Ramp	Provide required fill material at head of ramp to allow minimum o.2 m freeboard.	Complete

Figure 9

4.3.5 Ethel Lake

A. Recreation Setting and Existing Use

Ethel Lake is located in the east central section of the study area just 6 km west of English Bay on Cold Lake. About half of the shoreline is held by the Crown. This Crown land includes the public recreation facilities at the Recreation and Parks campground and the three group camps - Girl Guides, Boy Scouts and the St. Thomas Aquina Parish Parents and Teachers Association. The private shoreline supports cottage use and permanent residential use. The lake is fairly well served by paved or gravel roads which provide access to the north and west shores. The only public access is at the Recreation and Parks campground. Map 7 locates the existing use shorelands and the high capability shorelines. The 2.4 km of shoreline presently in recreation use accounts for about 24% of the total 10 km shoreline length.

The greatest amount of use at Ethel Lake occurs during the traditional recreation season of mid-May to September. Swimming is the most popular summer recreation activity. Other popular recreation activities include fishing, camping, sightseeing/relaxation and power boating. The Recreation and Parks campground supports all of these activities, including a boat launch ramp.

Ethel Lake experiences the typical weekend peak periods in both the cottage and public use areas. Weekday use of these two areas is approximately half of the weekend use. Total 1981 use is estimated at 8 459 user days which generated 39 870 activity occasions. Most of this use occurs at the Recreation and Parks campground although seasonal cottage use is significant.

The present use of Ethel Lake occurs primarily along two shoreline segments. These segments include the Recreation and Parks campground and cottage use areas at the northeast end of the lake and the Girl Guide and Boy Scout campsites at the south end of the lake. There are, however, other locations along the lakeshore which could support a range of shoreline and upland activities. These areas are primarily in private ownership which has prevented public development.

Based upon existing use patterns and interviews with cottagers and permanent residents, Ethel Lake is presently over used on weekends during the recreation season. This is due primarily to the lack of public access areas to disperse the camping and day use of the general public. The intensity of use at the existing Recreation and Parks campground indicates that the recreationists are seeking a high density, socially oriented experience.

B. Existing Water-based Recreation Capability

As noted in the Assessment Table (Table 23), the mean water level is 540.82 m which provides approximately 480 ha of usable water surface (1.0 m depth) and 0.64 ha of shoreline beach. The resources available at this mean level are capable of supporting approximately 88 000 water-based activity occasions and a total use - land and water-based - of about 150 500 activity occasions.(8) The estimated annual use at Ethel Lake is 39 900 activity occasions, or about 17% of the potential the resource could support at the mean water level.

C. Existing Resource Appraisal

As noted in Section A, Ethel Lake provides a specific type of recreation experience to the users of the Recreation and Parks campground. The cottagers and institutional users have located at Ethel Lake to take advantage of the natural resources of the lake and the surrounding area. This section identifies those resource characteristics which serve to create the setting desired by the present public users of Ethel Lake, however, it also considers the needs of the cottagers and institutional users in defining the "attractiveness" of the lake. The following characteristics should be provided to create a balance between cottagers and the general public.

(8) These figures represent an estimate of capability based upon the recreation area standards, party size and turnover rates for each activity as discussed in Appendix B.

Beach

- Length: relatively short sections, under 1 000 m.
- Width: minimum 1.0 m to be usable, and maximum of 20 m for campsites/cottages to be close to the water.
- Surface Materials: clean sand with few cobbles.
- Aspect: presently southwest and northeast.
- Location/Access: near developed facilities and with good vehicular access. Public beaches should be separated from cottage and institutional sites by breaks in beach quality or with upland vegetation.

Water Surface and Depth

- Usable Area: minimum of about 90% of the existing surface area (including the southeast bay) is required to maintain the inherent characteristics without conflict.
- Depth: for boating activities, a minimum depth of 1.0 m is required.(9)

Fishing Success

- Species: continued catches of whitefish, lake cisco, northern pike and yellow perch.
- Success Rate: the success rate is presently poor and needs improving.

Visual Quality

- Erosion along the shoreline should not exceed existing occurance.
- No mud flats created or increase in algae or emergent weeds.

Shoreline Facilities

- Vegative cover consisting of mixed deciduous trees for shade.
- Presence of understory for site definition and buffering.
- Developable slope for campsites, picnic sites, support facilities, e.g. washrooms, and cottages.

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(9) Canoes require about 0.6 m. As canoeing accounts for only 13% of the water surface use, the 1.0 m minimum depth will be used.

D. Comparison of Alternative Water Level Fluctuation Implications

At the mean water level, there is only 0.64 ha of usuable beach. This represnts a small proportion (20%) of the shoreline. This amount of beach could support approximately 6 times the amount of swimming which presently occurs at Ethel Lake.

At a +0.2 m water level, one of the two beach areas would be inundated, leaving approximately 0.35 ha of beach. This amount of beach would support about 3 times the existing swimming use. The increase in water surface area (2%) would provide only minor increases in water-based recreation activities. With a +0.5 m water level, the remaining beach site would be reduced to 7.5 m in width and to a width of 2.8 m at a +1.0 m water level. At the latter water level, swimming would be severely restricted and sunbathing activities would be confined to a small beach area. At the +0.5 m and +1.0 m water levels, extensive flooding of the low-lying backshores in the southeast corner of the lake would occur. Although these levels create more water surface area, there would be a minimal increase in the usuable water surface area due to the shallowness of the flooded areas. The specific area defined as unusable cannot be determined since there is no contour information available above the historical maximum water level. In addition, the erosion which would occur along the lakeshore at the higher (+0.5 and +1.0 m) water levels could cause deterioration of the water quality and the visual quality of the lake due to sediment loading and shoreline vegetation loss and decomposition. Projected inundation areas resulting from the +0.5 and +1.0 m water levels in the southeast side of the lake indicate that there would be an extensive loss in area at the Girl Guide and Boy Scouts of Canada campground and the St. Thomas Aquina Parish Parents and Teachers Association recreation site, and possible flooding of the road.

A decrease in water level to -0.2 m creates approximately 1.5 ha of beach area or over twice the amount of beach area available at the mean water level. Further decreases in the water level produce no new beach areas but create wider beaches at the existing sites, providing only minor increases in water-based recreation opportunities. Further, at the -1.0 m water level, the mouth of the southeast bay would become shallow, creating limited access to the bay for fishing. Also, at this level, extensive mud flats will be created along the southeast shoreline and at the point along the west shoreline, which separates the two bays.

E. Cost Allocation to Recreation With Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment table indicates the composite rating for each water level alternative. The inundation of one beach area and small amount of beach remaining at the +0.2 m water level would be marginally acceptable, as it would not result in a significant decrease in the recreation use of the lake where swimming is the most popular activity. The +0.5 m and +1.0 m water levels reduce the existing beach area significantly and floods an extensive portion of the southeast shore institutional recreation areas. Furthermore, flooded uplands and increased erosion could be significant, resulting in deteriorated water quality and visual quality due to sediment loading and tree fall.

If the lake level is decreased below the mean, more beach area will be created as the water surface area is reduced. The resource implications of the -0.5 and -1.0 m water levels have been identified in Section D. The impacts of these implications include: severe boating constraints posed by shallow areas and reduced water surface; the extensive loss of fish spawning and rearing habitat; and, the significant degradation of the aesthetic quality of the shoreline of the lake.

The resulting "acceptable" range is between the +0.2 m and -0.2 m water levels. The quantity and the quality of the available recreation resources within this range best maintains the present recreation value of the lake. It is these values that constitute the "attractiveness" of the resource to recreation users.

An "Ideal" range for Ethel Lake is difficult to determine due to the limited manipulation potential of the acceptable range. From a recreation standpoint, the lake level which provides the optimum amount of water surface area without erosion, and also provides the most productive fishery would be the "Ideal" level.

Based upon the fishery assessment, the "Ideal" water level would be approximately 0.1 to 0.2 m above the historic mean, or about 541.0 m. The possible improvement in the fishery would have to be compared with the potential impacts at this level.

- o Loss of one beach site and only 0.35 ha of usuable beach. This beach could however, sustain three times the current estimated use.

- o Sufficient water surface area (491 ha) to sustain approximately three times the existing boating use.

- o A relatively stable bank and shoreline, with only minimal erosion in the short term, and maintenance of the shoreline vegetation.

F. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "acceptable" range is 255 800 activity occasions at the -0.2 m water level, and 117 000 activity occasions at the +0.2 m water level. The very large capability at the lower water level is attributable to the additional swimming beach area produced. Swimming potential accounts for approximately 21% of the total capability at this water level. Even though swimming is the most popular activity, such a high amount of future swimming use is highly improbable. The activity that would realistically indicate the capability of the lake would be boat fishing, which represents an estimated 75% of the total fishing use. Since Ethel Lake is at present very heavily used from a recreation perspective, conflicts might be anticipated between the various activities the lake could support within the acceptable range.

G. Management Prescriptions

For the alternative lake levels proposed for Ethel Lake, the +1.0 m the -0.5 m, and the -1.0 m water levels are considered as having very limited mitigation potential and are therefore, not included in the Management Prescriptions (Figure 10). However, at the +0.5 m water level, the loss of one beach area could be mitigated by clearing some shoreline vegetation and regrading the slope suitable for the establishment of a new beach. The +1.0 m water level extensively inundates the southeast shore where the two institutional camps are located, and results in the loss of the use of the boat launch ramp in the north bay. Resolving these impacts at this level would not be feasible.

The apparent lack of mitigation potential for the two decreased levels stems from the impact these levels would have on the fish populations, and the resulting impact on the fishing activity the lake supports - both commerical and recreation. Also, at the -1.0 m water level, the mouth of the southeast bay becomes very shallow restricting the access to this portion of the lake.

H. Conclusions

The acceptable water level manipulation for the recreation use of Ethel Lake is between the +0.2 m and the -0.2 m water levels. The fluctuation range would be 0.4 m. Within this range, the existing use levels and patterns could easily be sustained, with the total resource capability of sustaining about three times the current use. The "Ideal" water level would correspond to the recommendation of the fishery assessment. This level would be about 0.1 m to 0.2 m above the historic mean, or 541.0 m.

The swimming beach area would be the limiting factor in achieving a higher capability level than noted in the Impact Assessment table unless management prescriptions were instituted which created additional beach area through vegetative clearing and slope grading. Since Ethel Lake is presently very heavily used, it offers very limited potential for increased future utilization in meeting the water-based recreation needs in the study area. The only way even minor additional use could be accommodated would be with the development of additional public facilities along presently unused portions of the shoreline.

Lake Level Impact Assessment

Ethel Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha; CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha; CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: R & P RAMP	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 541.82	-57 / 557	-.54 / .10	NU	15.8	0.8	15.8	7.4	8.0	7.1	54.9	+31.6 / -33.1	93.9	+54.0 / -56.6	NA	
+0.5m 541.32	+28 / 508	-.38 / .26	NU	14.9	0.7	14.9	7.0	7.5	18.5	63.5	+40.2 / -84.5	108.6	+68.7 / -41.9	NA	. Beach impacted . Boat ramp impacted . Flooding of backshore . Shoreline erosion
+0.2m 541.02	+11 / 491	-.29 / .35	OK	14.4	0.7	14.4	6.8	7.3	24.8	68.4	+45.1 / -19.6	117.0	+77.1 / -33.5	A	
Current Water Level 540.82 — ESTIMATED EXISTING	480	.64		5.4	0.4	4.7	2.0	2.9	7.9	23.3		39.9			IDEAL LEVEL = 541.00
Current Water Level 540.82 — ESTIMATED POTENTIAL				14.1	0.7	14.1	6.6	7.1	45.4	88.0		150.5			
-0.2m 540.62	-11 / 469	+.88 / 1.52	NU	13.8	0.6	13.8	6.5	7.0	101.9	149.6	+186.5 / +61.6	255.8	+215.9 / +105.3	A	
-0.5m 540.32	-28 / 452	+2.17 / 2.81	NU	13.3	0.6	13.3	6.3	6.7	199.5	239.7	+216.4 / 151.7	409.9	+370.0 / +259.4	NA	. Fishery impacted . Loss of water surface area
-1.0m 539.82	-37 / 423	+4.37 / 5.01	NU	12.9	0.6	12.9	5.9	6.3	355.7	393.3	+370.0 / +305.0	672.5	+632.6 / +522.0	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE

Existing Use Areas

N

SHORELINE AREAS

1. Transportation Campground
   - good sandy beach between 0.5 m increase and 0.2 m decrease
   - boat ramp usable between 0.2 m increase and 0.2 m decrease
   - good upland site

2. Northwest Shore Cottages
   - good backshore but inundated at increase greater than 0.2 m
   - weedy offshore zone widened with decreased levels

3. St. Thomas Acquina Parish Parents and Teachers Association
   - similar to Area 2

4. Girl Guides & Boy Scouts of Canada
   - limited backshore
   - silt bottom and weedy offshore

5. - good beach between 0.5 m decrease and mean
   - excessive beach width at decreases greater than 0.5 m
   - excellent backshore

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1"=400'

Ethel Lake

Management Prescriptions

ETHEL LAKE

LAKE LEVEL	RESOURCE FACILITY OR ACTIVITY IMPACTED WITH MITIGATION POTENTIAL	MANAGEMENT PRESCRIPTION	DEGREE OF MITIGATION
+ 0.5 m	Shoreline Erosion	Provide vegetative clearing and grading of upland bank along high erosion potential shorelines.	Partial
	Shoreline Beach	Provide vegetative clearing and slope grading along beach area in northwest corner to provide minimum 1.0 m wide sand beach.	Complete

Figure 10

4.3.6 Marie Lake

A. Recreation Setting and Existing Use

Marie Lake is one of the larger lakes in the study area, located just northwest of Cold Lake. Access to the lake is via a gravel road from the Town of Cold Lake. There is no vehicular access to the north and west shores.

Development occurring on the south and east shorelines includes private cottage development scattered along the shoreline, a government cottage subdivision, and the CFB tent and trailer campground. The only boat launch ramp is located in the CFB campground and several private docks have been developed in association with the cottages. There are no facilities or access points to the lake for general public use. The developed shoreline (2.75 km) accounts for approximately 9% of the total shoreline. The high capability shorelines are shown on Map 8.

Marie Lake receives moderate recreation use compared with the other lakes in the system. The highest use is during the summer months. Similar to most lakes, there is limited fall and winter recreation use. The primary recreation activities at Marie Lake are swimming, fishing, camping, sightseeing and relaxation with other popular activities such as motorboating, water skiing, canoeing, hiking and photography also occurring.

During the summer of 1981, Marie Lake received an estimated recreation use of 24 438 activity occasions. Approximately 41% of the total use occurs at the CFB campground. Typically, the campground is 80% occupied throughout the summer season with a heavy period of over 100% occupancy during the annual block vacation leave during mid-summer. The campground receives light usage on weekdays and the weekends are generally heavily used. The cottage subdivision and the cottages scattered around the lake receive approximately 59% of the total lake use. Weekends are the heaviest summer use periods for the cottages.

The existing use patterns at Marie Lake indicate that there are two user groups, the military personnel and their families at the CFB campground and the cottage owners. If access is improved, the demand for cottage lots in the area will increase. It is therefore anticipated that Marie Lake may receive significantly more use in the future.

B. Existing Water-Based Recreation Capability

The historic mean water level is 573.52 m which provides approximately 3 419 ha of usable water surface area and 4.47 ha of shoreline beach. Based upon the Impact Assessment Table (Table 24), the lake could potentially support approximately 500 100 water-based activity occasions and a total use, both land and water-based, of about 828 700 activity occasions.(10) At present, the lake is being used at about 19% of its resource capability.

C. Existing Resource Appraisal

Marie Lake provides water-based recreation opportunities for the military personnel and cottage users. Since Marie Lake is one of the largest lakes in the study area, and provides high quality recreation opportunities, it is anticipated that it could attract a significant proportion of the recreation market of the study area. However, unless access is improved for the general public, the lake will never approach its inherent capability for recreation use. This section identifies those resource characteristics which serve to create the high quality recreation experience, and therefore, should be maintained if Marie Lake is to continue to provide this quality experience.

Beach

- Length: a mix of both long (1 000 - 2 000 m) and short (700 - 900 m) sections.
- Width: generally all beach areas moderately wide (5 m).
- Surface materials: clean sand with some cobbles.
- Aspect: presently in all directions - southwest is ideal.
- Location/Access: existing developments accessible by road from south and east side of lake - boat access beaches quite open. Semi-private access points along narrow beaches associated with cottages.

(10) These figures represent an estimate capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

Water Surface and Depth

- Usable area: minimum of 55% (2 000 ha) of the existing water surface area is required to maintain inherent characteristics and to provide for the range of water surface activities without conflict.

- Depth: for boating activities, a minimum depth of 0.6 m is required.(11)

Fishing Success

- Species: Whitefish and Lake Cisco.
- Success rate: presently marginal success rate, improved fishery would be an asset.

Visual Quality

- No apparent erosion.
- No mudflats or increase in algae.

Shoreline Facilities

- Continued usability of the boat ramp and private docks throughout recreation season.

Backshore

- Vegetative cover consisting of mixed deciduous trees for shade.
- Presence of understory for site definition and visual buffers.
- Developable slopes for campsites, picnic sites and support facilities.

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(11) Canoes require a minimum depth of 0.6 m. Due to the high level of canoe use on this lake, the 0.6 m depth will be used.

D. Comparison of Alternative Water Level Fluctuation Implications

There will be a variety of negative impacts both on the existing recreation facilities as well as the potential sites on Marie Lake should the water level be increased. At the +0.2 m water level, there will be partial loss of beach area at the cottage subdivisions and CFB campground, but no permanent recreation facility would be negatively impacted. There would only be a slight increase in the surface area of the lake; thus accruing only minor benefits for water surface recreation activities.

With the water at the +0.5 m and +1.0 m level, the entire beach area at the CFB campground and government subdivision would be inundated. For the entire lake only 0.46 ha of beach area would remain usable at the +0.5 m water level. There would be only minor increases in the water surface area and only minor benefits to water surface recreation activities at these two higher water levels.

Decreases in the water level from the mean generally expose more beach area, consequently providing more opportunities for beach activities. Decreases also result in a smaller surface area and a subsequent loss in opportunities for activities such as fishing, power boating and sailing. The -0.2 m water level exposes approximately twice as much beach area as is found at the mean level. The loss in water surface recreation opportunities is insignificant. A further decrease to the -0.5 m water level creates four times the amount of beach area found at the mean level. However, the beach areas are quite wide (12 to 32 m) leaving the boat ramp at the CFB campground and the boat docks in the cottage subdivision unusable. A further decrease to the -1.0 m water level exaggerates the problem of unusable shoreline facilities. The beaches do become wider but the distance to the water from the cottages is increased, creating undesirable conditions. Only an insignificant amount (5%) of water surface area would be lost at the -1.0 m water level.

E. Cost Allocation to Recreation with Alternative Water Level Fluctuations

The Summary Rating column on the Impact Assessment table indicates the composite rating for each water level alternative. Increases in the water

level above the mean are acceptable to the +0.2 m level. Further increases above this level result in either a partial or total loss of the beach area, flooding of permanent docks and the boat launch, and inundation of backshore areas at the government cottage subdivision. The loss of beach areas would be unacceptable since swimming is the most popular recreation activity.

If the lake level is decreased below the mean, more beach area is created as the water surface area is reduced. The -0.2 m water level would still provide an acceptable water level from a recreation perspective. Decreases in the water level to -0.5 m and -1.0 m would be unacceptable as the shoreline would be too far from the cottages for an enjoyable experience and the existing boat ramp and docks would be left well above the water line.

In summary, the acceptable lake level manipulation range is between the -0.2 m and +0.2 water levels since these levels would create only a minimal negative impact on the recreation potential of the lake. Since decreases in the water level are considered unacceptable in the fishery assessment, the "Ideal" water level would be at, or slightly above, the mean water level at approximately 573.60 m.

F. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "acceptable" range is 625 400 activity occasions at the +0.2 m water level to 1 497 200 activity occasions at the -0.2 m water level. The significant increase in the resource capability at the lower water level can be attributed to the additional swimming beach area created. Swimming potential accounts for about 43% of the total capability of the lake. Since Marie Lake is currently under-utilized from a recreation perspective, no conflicts are anticipated between any of the activities.

G. Management Prescriptions

In some instances, the negative impacts of the water levels discussed above can be partially or completely mitigated depending upon the severity of the problem. In Figure 11, Management Prescriptions are identified for the facility or resource being impacted. In addition, a qualitative assessment of the success rate of the mitigation is provided.

For the +0.5 m water level, mitigation is considered feasible. However, at extreme high water levels (> .5 m), it would not be feasible to modify the shoreline because of the extensive backshore flooding and increased erosion potential.

If the water level is decreased by 0.5 m, the partial or total loss of use of the boat ramp and permanent docks can be mitigated. At extreme decreases in water level (> .5 m), the distance to boat ramps and docks from the cottages is a major constraint.

H. Conclusions

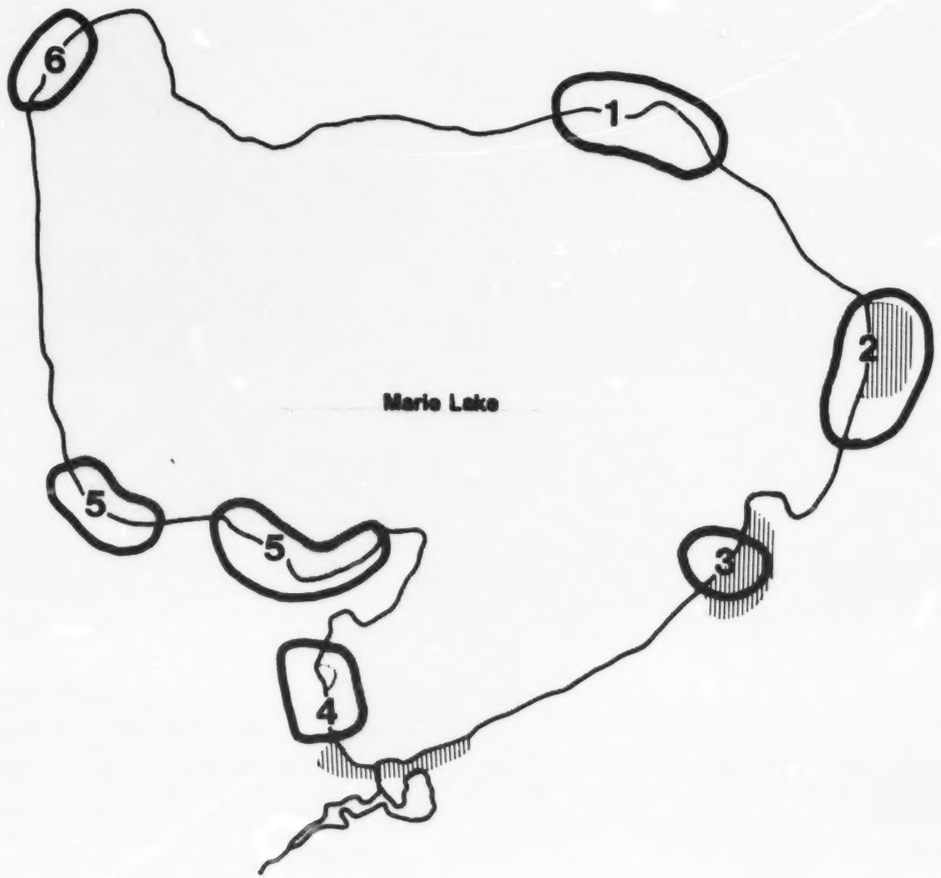
The acceptable water level manipulation for the recreation use of Marie Lake is between the +0.2 m and the -0.2 m water levels. The water level providing the highest resource potential is the -0.2 m water level. Within this range the existing use levels and patterns could easily be sustained, with the total resource base being capable of sustaining at least four times the current use. The swimming beach area would be the limiting factor in achieving a higher capability level than noted in the Impact Assessment table unless management prescriptions were instituted which created additional beach area. With the present quality of the fishery considered marginal at best, the "Ideal" water level would be that level within the acceptable range which enhances the fishery. This level would be at, or sightly above, the mean water level, or approximately 573.60 m. Since Marie Lake is currently under-utilized, it offers significant potential for increased utilization in the future within the range of water level alternatives described above.

Lake Level Impact Assessment

Marie Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha — CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha — CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: CFB RAMP	PRIVATE DOCKS	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 574.52	+203 / 3622	⊖	PL	NU	46.3	21.2	36.6	33.9	35.6	⊖	193.6	+102.6 / -306.5	380.8	+170 / -507.9	NA	
+0.5m 574.02	101 / 3520	-4.01 / .46	OK	NU	45.0	20.6	35.0	33.0	34.6	32.7	820.9	+129.9 / -879.2	866.1	+815.3 / -462.6	NA	. Peach impacted . Boat ramps & docks impacted . Shoreline erosion
+0.2m 573.72	41 / 3460	-1.76 / 2.71	OK	OK	44.2	20.3	34.0	32.4	34.1	192.4	377.4	+286.4 / -122.7	625.4	+474.6 / -203.3	A	
Current Mean 573.52 — ESTIMATED EXISTING	3419	447			16.1	7.0	15.1	14.5	14.5	23.8	91.0		150.8			IDEAL LEVEL = 573.60
Current Mean 573.52 — ESTIMATED POTENTIAL					43.7	20.0	33.4	32.0	33.6	317.4	500.1		828.7			
-0.2m 573.32	41 / 3378	+5.71 / 10.18	PL	OK	43.2	19.8	32.8	31.7	33.2	1329.8	903.5	+812.5 / +403.4	1497.2	+1346.4 / +668.5	A	
-0.5m 573.02	-101 / 3318	+14.26 / 18.73	NU	NU	42.9	19.4	31.8	31.1	32.7	1329.8	1507.2	+1416.2 / +1007.1	2497.6	+2396.8 / +1668.9	NA	. Boat ramps & docks impacted . Distance from cottages to shoreline
-1.0m 572.52	-203 / 3216	+28.61 / 33.08	NU	NU	41.1	18.8	30.2	30.1	31.7	2348.7	2520.6	+2429.6 / +2020.5	4177.0	+4026.2 / +3348.3	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



Existing Use Areas

N

SHORELINE AREAS

1. . excellent sandy beach between 0.2 m decrease and 1.0 m decrease
   . wide beach (up to 21 m) at decrease
   . excellent development potential of backshore
   . some backshore flooding at 0.5 m
2. Government Subdivision
   . same beach conditions as area 1
   . possible flooding of subdivision at 1.0 m increase
3. C.F.B. Tent and Trailer Campground
   . same beach conditions as area 1
   . excellent beach on only 1/2 of lake frontage

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1"=320'

Marie Lake

Management Prescriptions

MARIE LAKE

LAKE LEVEL	RESOURCE FACILITY OR ACTIVITY IMPACTED WITH MITIGATION POTENTIAL	MANAGEMENT PRESCRIPTION	DEGREE OF MITIGATION
+ 0.5 m	Shoreline Beach	Provide vegetation clearing and slope grading along existing beach access shorelines at cottages and CFB Campground to provide minimum 1.5 m wide sand beach.	Complete
	Shoreline Erosion	Provide vegetation clearing and grading of upland bank along high erosion potential shorelines.	Partial
	Private Docks	Replace with floating docks.	Complete
	Boat Launch Ramp	Provide required fill material at head of ramp to allow minimum 0.2 m freeboard.	Complete
- 0.5 m	Private Docks	Replace with floating docks.	Complete
	Boat Launch	Extend existing ramp to minimum .75 m depth.	Complete

Figure 11

4.4 Level 2 Lake Assessments

4.4.1 Angling Lake

A. Recreation Setting and Existing Use

Angling Lake is approximately 35 km southeast of Bonnyville just north of Reita Lake. Access to the lake is limited to the east side via a gravel road. Existing recreation developments consists of Beaverdam Centennial Park and a small Recreation and Parks campground. A commercial campground, which is no longer in operation, is also located along the southeast shore of the lake. There are no cottages or permanent residents along the lake shore. Map 9 locates the existing use areas and high recreation capability shorelines.

The greatest amount of recreation use at Angling Lake occurs during the traditional recreation season from May to September with the highest use taking place during early summer when the water quality is apparently best for swimming and fishing. Swimming has been a popular activity but, in recent years, local residents have reported cases of "swimmers itch". Use of the lake tapers off by the beginning of August with limited use during the fall and winter.

Based upon the estimated use of the lake, recreation fishing is the primary activity followed by sightseeing/relaxation, camping and swimming. Beaverdam Centennial Park provides access to the lake for these activities but no boat ramp or other facilities are developed on the shoreline.

In 1981, the lake received approximately 8 170 activity occasions of recreation use primarily in the activities of fishing, camping and swimming. Angling Lake ranks eighth among the thirteen lakes in the study area with respect to the amount of recreation use. Fishing for Whitefish, Walleye and Pike occurs primarily in the early summer largely from non-resident campers at the Recreation and Parks campground.

In summary, Angling Lake provides a recreation experience centred around fishing. Non-residents take advantage of the campground facilities during their fishing trips; local residents tend to use the lake and associated facilities for day-use activities such as fishing. The lake, however, is

currently under-utilized because of its limited access and lack of developed recreation facilities. Clearly, it is important to maintain or enhance the fishery to ensure Angling Lake continues to provide the desired recreation experiences.

B. Existing Water-Based Recreation Capability

As noted in the Impact Assessment Table (Table 25), the mean water level of 556.88 m provides approximately 596 ha of water surface area. There is no shoreline beach at this water level. The resources available at this mean level are capable of supporting approximately 63 500 water-based activity occasions and total use - land and water-based - of about 153 100 activity occasions.(12) The estimated existing annual use at Angling Lake is 8 170 activity occasions, or about 5% of the potential the resource base could support at the mean water level.

C. Comparison of Alternative Water Level Fluctuation Implications

As noted in Section B, all of the beach area observed during the field reconnaissance by ENR as noted in the shoreline disruptions is inundated at the mean water level. At the +0.2 m and +0.5 m water levels, the relatively steep lake margins on the south and east shores prevent flooding of the backshores. In fact, the high water levels would improve the ability to launch boats and canoes along the upland banks. In addition, the water surface area of the lake would be increased 4 to 10% at these higher levels. Furthermore, the +1.0 m water level would result in extensive flooding of the lowlying backshores at the north and northwest sides of the lake. There would also be considerable erosion of the upland banks with possible vegetation fall which could cause a deterioration of both the water quality and visual quality of the lake.

The -0.2 m water level exposes a 2.0 ha sandy beach at the Recreation and Parks campground. This beach alone has the potential to sustain 142 000 activity occasions or over 95 times the current estimated swimming use.

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(12) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

At this reduced water level, the beach is 10 m wide and restricts the use of the existing informal boat launch area. Any decrease greater than 0.2 m will substantially increase the beach area, but would provide only minor benefits to the recreation potential of the lake. At several other areas of the shoreline where the slopes are shallow and the lake bottom is silt, extensive mud flats and wide margins of emergent vegetation would be exposed. The -0.5 and -1.0 water levels would, therefore, be unacceptable from the recreation perspective.

D. Cost Allocation To Recreation With Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment table indicates the composite rating for each water level alternative.

At the mean water level, there is no beach area. At the +0.2 m and +0.5 m water levels, the water surface area is increased by 4 to 10% creating more opportunities for water surface recreation. Since boating and fishing are the most popular activities, these increases would be acceptable. Water levels above this would result in extensive backshore flooding and shoreline erosion resulting in deteriorated water quality and visual quality caused by sediment loading and tree fall.

Decreases in the lake level below the mean level will expose more beach area as the water surface area is reduced. At the -0.2 m water level a beach is exposed providing an additional recreation opportunity. Unfortunately, the presence of "swimmers itch" in the lake during the late summer would severely restrict the benefits of a wider beach in spite of the excellent opportunities presented. The resource implications of the -0.5 and -1.0 m water levels have been identified in Section C. The impacts of these levels include: severe boating constraints posed by shallow areas and reduced water surface; the extensive loss of fish spawning and rearing habitat and the significant degradation of the aesthetic quality of the shoreline of the lake.

The resulting "Acceptable" range includes the fluctuation from the mean level to the +0.5 m water level. The quantity and the quality of the available recreation resources within this range best maintains the

present recreation value of the lake. It is these values that constitute the "attractiveness" of the resource to recreation users. The resulting increase in water surface area would be approximately 58 ha at the +0.5 m water level.

Determining an "Ideal" range is difficult when the various resource management interests are considered. From a recreation standpoint, the lake level which provides the most productive fishery and swimming beach area would be the "Ideal" level. However, based upon the analysis, such an "Ideal" situation does not exist and the interests of the majority of the users (fishermen) would take precedence over the swimming interests. Based upon the fishery assessment, the "Ideal" water level would be toward the middle of the acceptable range or about 557.10. In addition to a productive fishery, this level would provide:

- sufficient water surface area (622 ha) and depth (minimum 0.5 m, average 9 m) to sustain the existing use and potential future increases;

- improved shoreline conditions for boat launching; and

- a continued stable bank and shoreline without a large "bathtub ring" or excessive erosion and loss of shoreline vegetation into the lake, thus maintaining the water quality and visual quality of the lake and shoreline.

E. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "Acceptable" range is 153 100 activity occasions at the mean water level, and 163 700 activity occasions at the +0.5 m water level. The slight gain of capability from the mean level is attributed to the larger water surface. Boat fishing potential accounts for about 42% of the total recreation capability at the mean level. As Angling Lake is currently under-utilized from a recreation perspective, no conflicts would be anticipated between the various activities the lake could support within the acceptable range.

F. Conclusions

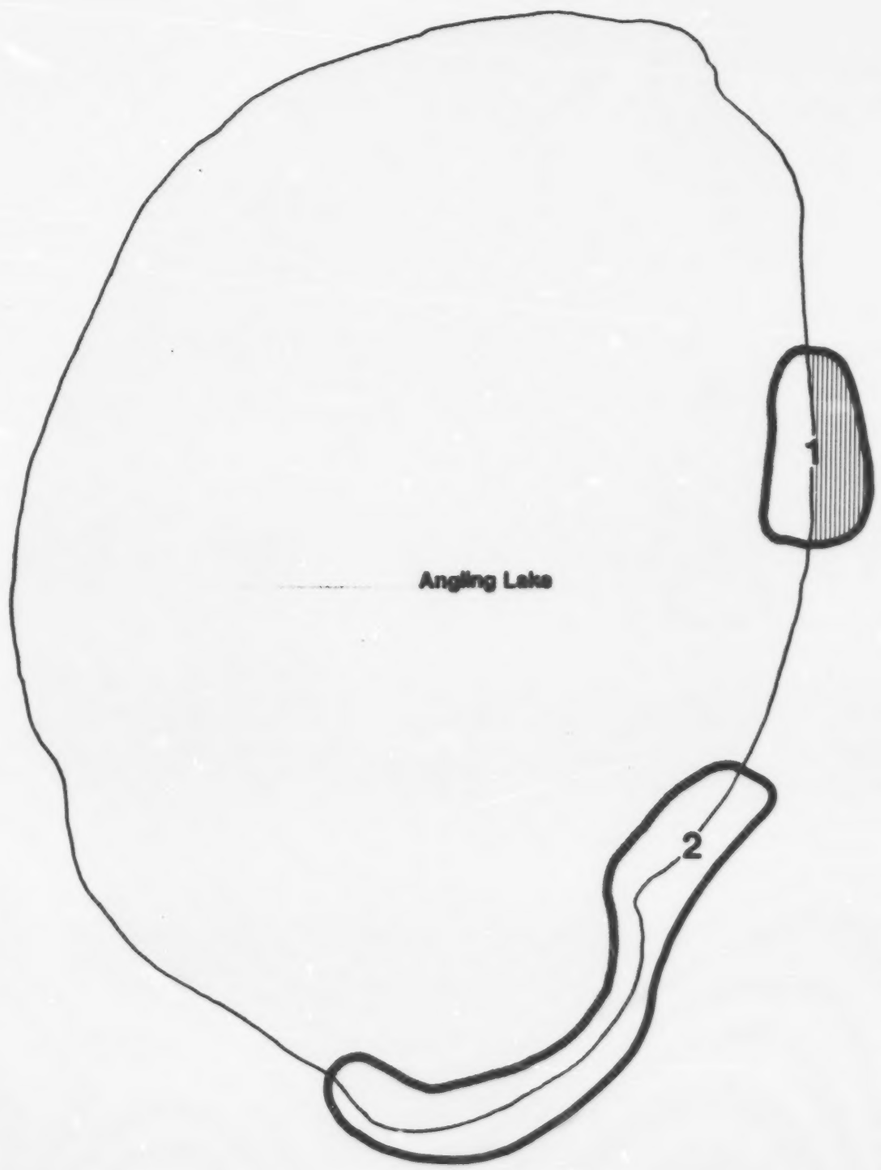
The acceptable water level manipulation for the recreation use of Angling Lake is to the +0.5 m water level. Within this range, the existing use levels and patterns could easily be sustained, with the total resource capability of sustaining at least 18 times the current use. The "Ideal" water level would be about the mid-point of the acceptable range or about 557.10. This level improves the fishery which is the primary recreation resource. Since Angling Lake is presently under-utilized, it offers very significant potential for increased future utilization in meeting the water-based recreation needs in the system.

Lake Level Impact Assessment

Angling Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha / CHANGE FROM CURRENT BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha / CHANGE FROM CURRENT BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS/ ASSUMPTIONS
+1.0m 557.88	+116 / 712	⊖		66.7		4.7	2.5		⊖	73.9	+70.0 / +10.4	178.2	+170 / +25.1	NA	. Shoreline erosion . Flooding of backshore . Boat ramp impacted
+0.5m 557.38	+58 / 654	⊖		61.3		4.3	2.3		⊖	67.9	+64.0 / +4.4	163.7	+155.5 / +10.6	A	
+0.2m 557.08	+83 / 619	⊖		58.0		4.1	2.2		⊖	64.3	+60.4 / +0.8	155.1	+146.9 / +2.0	A	
Current Mean 556.88 — ESTIMATED EXISTING	596	⊖		1.6		0.2	0.1		1.5	3.4		8.2			IDEAL LEVEL = 557.10
Current Mean 556.88 — ESTIMATED POTENTIAL				55.9		4.0	2.1		1.5	63.5		153.1			
-0.2m 556.68	+23 / 573	+2.0 / 2.0		53.7		3.8	2.0		142.0	301.5	+197.6 / +138.0	486.0	+477.8 / +332.9	NA	. Loss of water surface area . Fishery impacted
-0.5m 556.38	+58 / 538	+5.0 / 5.0		50.4		3.6	1.9		358.0	410.9	+407.0 / +347.4	991.0	+982.8 / +857.9	NA	
-1.0m 555.88	-116 / 480	+10 / 10		45.0		3.2	1.7		710.0	759.9	+756.0 / +696.4	1838.7	+1829.5 / +1679.6	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



Existing Use Areas

N

SHORELINE AREAS

1. Beaver Dam Centennial Park and Transportation Campground
   - . boat launch ramp abandoned on steep lake margin
   - . no beach area with weedy foreshore zone
   - . improved boat launching capability at 0.2 m increase
   - . wide weedy lake margin at 0.2 m decrease

2. . beach inundated at mean
   - . reasonable sandy beach from just below the mean to 0.5 m decrease with weedy foreshore
   - . extensive erosion of upland bank at 0.5 m increase

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan Western Limited

Scale 1:5000

Angling Lake

4.4.2 Manatokan Lake

A. Recreation Setting and Existing Use

Manatokan Lake is a small shallow lake consisting of two bays. Since the lake is located only 36 km northwest of Bonnyville and has reasonable access via a gravel road, it receives considerable local and non-resident recreation use. It is well known by locals for its water-based recreation activities including fishing, camping, swimming, and boating.

Even though the lake is fairly small, it supports two recreation developments: a Transportation campground with a boat launch ramp and a small commercial resort with an informal boat launching site. Both facilities are located on the east shore of the west bay. A cottage subdivision has also been proposed on the north shore of the west bay. In addition, there are three permanent residences on the lake, with the majority of the surrounding land in agriculture. Map 10 locates the existing use areas and the high recreation capability shorelines.

The present use of Manatokan Lake occurs in two general locations along the north and east shores of the west bay. There is, however, an undeveloped site along the west shore of the west bay that could support a range of shoreline and upland recreational activities. The east bay is very shallow (0.2 - 0.5 m) and contains a lush growth of aquatic and emergent vegetation. There is no shoreline beach potential and the water surface use is limited to flat bottom motor boats or canoes.

The lake receives the majority of its use during the summer recreation season (May to September). The Transportation campground and commercial resort are generally filled to capacity during summer long weekends and enjoy reasonable occupancy rates during the remainder of the summer season. During the fall, the lake is a popular duck hunting location for both local and non-resident hunters.

Based upon the estimated use for the 1981 season, the most popular activities are fishing, swimming, camping, sightseeing/relaxation and power boating. The recreation use of the lake is estimated to be approximately 29 182 activity occasions, of which 45% is attributed to fishing and swimming.

In summary, Manatokan Lake experiences a moderate to high use during the summer season. Both local and non-residents appear to be attracted to the lake for its fishing, camping and swimming opportunities. Clearly, it is important to maintain or create additional opportunities for these three activities in order to ensure Manatokan Lake continues to provide the desired recreation experiences.

B. Existing Water-Based Recreation Capability

As identified in the Assessment table (Table 26), the mean water level is 555.29 m which provides approximately 471 ha of water surface area and 0.42 ha of shoreline beach. The resources available at this mean level are capable of supporting approximately 62 615 water-based activity occasions and a total use - land and water-based - of about 123 100 activity occasions.(13) The estimated existing use at Manatokan Lake is 29 182 activity occasions, or about 24% of the potential the resource could support at the mean water level.

C. Comparison of Alternative Water Level Fluctuation Implications

Based upon the assessment of the potential beach areas, 89% of the beach area identified in the shoreline assessment is available at the mean level. However, the beaches on the west shore and north shore are entirely inundated, leaving only a 500 m stretch of shoreline near the Transportation campground. At the +0.2 m and +0.5 m water levels, there would be some flooding of the lowlying backshores in the southwest shore of the west bay. Generally however, there would be very little change to the remainder of the shoreline in the west bay.

The impacts on the boat launch sites cannot be determined at this time because of the limited field data. The flat, lowlying backshores along the east bay would be extensively flooded, but probably not have any major negative impact on the water quality and could possibly benefit the fishery. Water levels above +0.5 m would result in extensive flooding of

(13) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

the backshore of the east bay (flooding almost twice as much land as the existing bay) and the organic zones on the west and south shores of the west bay. This could result in a significant deterioration of the water quality and visual attractiveness from sediment loading and tree fall. Therefore, the +0.5 m and +1.0 m water levels would not be acceptable.

Since the lake is very shallow at the mean water level, the slightest decrease could have significant negative implications to the fisheries, although it would expose more beach area. At the -0.2 m water level, an additional 3.8 ha of beach would be available for swimming opportunities at all the locations identified on Map 10. Since swimming is a popular activity, the additional beach area could provide 45 times the existing use. Unfortunately, it is unrealistic to attract that much swimming use to Manatokan Lake because of its small size and lack of developed facilities. In fact, even at the mean level, the estimated existing use represents only 20% of the estimated swimming potential. Therefore, the benefits accrued by this decrease would be relatively insignificant.

D. Cost Allocation to Recreation With Alternative Water Level Fluctuation

From the fisheries perspective, there would be significant negative impacts from any decrease of the mean due to the reduction in fish spawning grounds and the possibility of winter kill in the shallow east bay. Based upon this assessment, and because fishing is one of the most popular activities, a decrease even to the -0.2 m water level would be unacceptable. Further decreases would have detrimental affects on the fisheries and subsequently, the recreation opportunities. At the -0.5 m water level, the east bay would be reduced to half the size at the mean level and below the -1.0 m water level the east bay would be lost entirely.

The resulting "Acceptable" range includes the fluctuation from the mean to a +0.5 m increase. The quantity and quality of the lake and shoreline resources within this range best maintains the present recreation attractiveness of the lake. Benefits accrued within this water level range would be an enlarged water surface area of approximately 529 ha, the use of the east arm for fishing and boating, an enhanced fishery, and enough beach area (0.3 ha) to sustain about 14 times the existing swimming use. The "Ideal" level would be toward the midpoint of this range, or approximately 555.5 m.

E. Evaluation of Recreation Resource Capability

The land and water-based recreation resource capability for the "Acceptable" range is 123 100 activity occasions at the mean water level and 113 400 activity occasions at the +0.5 m water level. The slight loss in capability at the +0.5 m level is due to the loss of beach area and the corresponding reduction in swimming capability. Even at the +0.5 m level, the beach resources are capable of sustaining more than three times the existing estimated swimming use.

F. Conclusions

The acceptable water level manipulation for the recreation use of Manatokan Lake is to the +0.5 m water level. Within this range, the existing use levels and patterns could easily be sustained with the total resource capability of approximately four times the current use. The "Ideal" level would be about 555.5 m. Manatokan Lake is currently under-utilized, but considering the shallowness of the lake, the sensitivity of the east bay to fluctuations and intense use, and the limited amount of potential beach areas, the lake can only satisfy a moderate proportion of the water-based recreation demands in the study area.

Lake Level Impact Assessment

Manatokan Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha / CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha / CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES: R & P RAMP	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (X 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (X 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS: ASSUMPTIONS
+1.0m 556.29	+105 / 576	-.29 / .175	NU	24.5		10.9	2.7	1.5	12.4	52.0	+37.2 / -10.6	102.2	+75.0 / -20.9	NA	. Shoreline erosion . Flooding of backshore on east bay . Boat ramp impacted
+0.5m 555.79	+58 / 529	-.185 / .30	PL	22.5		10.0	2.5	1.4	21.3	57.7	+42.9 / -4.9	113.4	+84.8 / -9.7	A	
+0.2m 555.49	+23 / 494	-.08 / .375	OK	21.0		9.4	2.3	1.3	26.6	60.6	+45.8 / -2.0	119.2	+30.0 / -3.9	A	
Current Mean Stage ESTIMATED EXISTING	471	.425		4.9		2.2	0.7	0.4	6.6	14.8		29.2			IDEAL LEVEL = 555.50
Current Mean Stage ESTIMATED POTENTIAL				20.1		8.5	2.1	1.2	30.2	62.6		123.1			
-0.2m 555.29	-22 / 449	+3.8 / 4.825	PL	19.1		8.5	2.1	1.2	300.0	330.1	+345.3 / +867.5	649.0	+619.8 / +585.9	NA	. Loss of water surface in east bay . Fishery impacted
-0.5m 554.79	-67 / 414	+9.585 / 9.95	NU	17.6		7.9	2.0	1.1	706.5	785.0	+780.2 / +672.4	1445.2	+1416.0 / +1322.1	NA	
-1.0m 554.29	-117 / 354	+19.185 / 19.55	NU	13.1		6.7	1.7	0.9	1383.1	1412.4	+1387.6 / +1349.8	277.1	+247.9 / +154.0	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE

Existing Use Areas

N

SHORELINE AREAS

1. . excellent beach between mean and 0.2 m decrease
   . algae blooms offshore
   . backshore inundated with increases greater than 0.2 m

2. Transportation Campground and Bonanza Beach
   . excellent sand beach between mean and

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1:5000

Manatokan Lake

4.4.3 May Lake

A. Recreation Setting and Existing Use

May Lake is located in the north section of the study area, just south of the Primrose Lake Air Weapons Range. The lake is fed by Marie Creek, about 11 km upstream from Marie Lake. Access is limited to float planes or 4 wheel drive vehicles. No developed facilities are provided although an informal campground has evolved where the access trail meets the lake shore. The estimated 400 activity occasions at May Lake in 1981 were attributable to fishing and camping only.

Due to the limited access and the lake's designation as a trophy fishing lake, the character of use would be considered resource oriented. The recreationists find the lake and its shorelands rustic and primitive, with fishing as their primary activity. Overnight camping is almost a necessity due to the limited access, consequently this activity accounts for as many activity occasions as fishing.

B. Existing Water-Based Recreation Capability

The three shoreline segments on May Lake that could support a range of shoreline and upland activities are shown on Map 11. Two of these segments constitute the majority of the east shore and total about 3 000 m. The third is located along the west shore toward the south end and measures about 700 m.

As noted in the Impact Assessment Table (Table 27), the water level is 99.49 m[14] which provides approximately 313 ha of usable water surface area, and 0.62 ha of shoreline beach. The table shows that the resources available at this mean level are capable of supporting approximately 60 500 water-based activity occasions and total use - land and water-based - of about 241 900 activity occasions.[15] The estimated annual use at May Lake is 400 activity occasions, or less than 1% of the potential the resource could support at the mean water level.

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(14) Lake level is recorded from an assumed datum.

(15) These figures represent an estimate of capability based upon the recreation season, area standards, party size and turnover rates for each activity as discussed in Appendix B.

C. Comparison of Alternative Water Level Fluctuation Implications

At the mean water level, the few existing beaches are narrow. An increase to the +0.2 m water level results in the loss of all beach areas.

This increase in the water level provides only minor increases in the usable surface area, due to the configuration of the lake margin and upland. At water levels greater than +0.2 m, the erosion which would occur along the lake shore could cause deterioration of the water quality and of the visual quality of the lake due to sediment loading and tree fall along some of the shoreline. Flooding of the phreatic zone at the south end of the lake would also occur. The shallow depth of this area, however, does not permit boating, and therefore, has not been considered as usable water surface area.

At the -0.2 m water level, only a minor increase in beach area (1.36 ha) is created and results in a insignificant loss of water surface area. Further water level reductions will result in only moderate increases in beach area, while the usable water surface area decreases at a moderate rate (24% at the -1.0 m water level). The south end of the lake is quite shallow, consequently reducing the use of this portion of the lake. The exposure of these weedy shallows will create a deterioration in the visual quality of the lake and a significant loss of fish habitat.

D. Cost Allocation to Recreation with Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment table indicates the composite rating for each water level alternative. No water level fluctuation is considered acceptable for May Lake. This rating is based primarily on the recommendations for the fishery which represents the most significant natural recreation resource at the lake. This activity is the main, if not the only, reason for visiting the lake. The fishery impact assessment indicates that any water level increases or decreases would adversely effect the sensitive trophy fishery the lake supports.

E. Evaluation of Recreation Resource Capability

Since the recreation potential of May Lake is highly dependent on the fishery resource, maintaining the mean water level would be best from the recreation perspective. At this water level, the lake has the capability to sustain 60 500 water-based recreation activity occasions and 241 900 activity occasions of both water and land-based. Swimming capability accounts for approximately 72% of the potential water-based capability. Since May Lake is primarily a fishing lake, such a high amount of future swimming use is highly improbable. The activity that would realistically indicate the lake's capability would be boat fishing, which represents an estimated 50% of the total fishing use. Since May Lake is presently under-utilized from a recreation perspective due to the limited access, no conflicts would normally be anticipated between the various activities the lake could support within the acceptable range. However, due to the Trophy Lake status, the activity of fishing should be the primary activity for which the lake is managed.

F. Conclusions

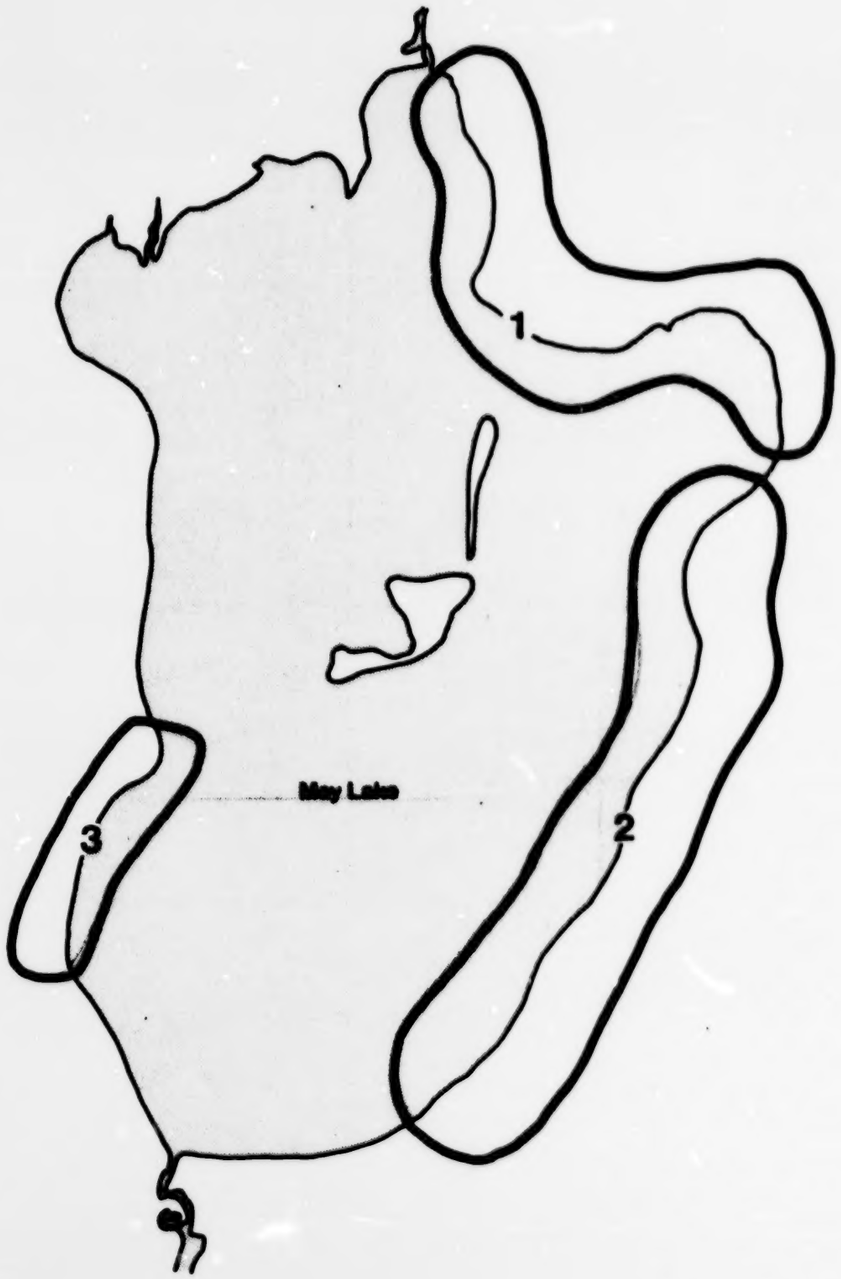
Because of the significant negative impacts to the fisheries from any increase or decrease in the water level, maintaining the mean water level would be the most acceptable scenario. The under-utilization of May Lake results primarily from the restricted access. If the existing trail was improved to permit access by two wheel drive vehicles, May Lake could offer significant potential for increased future utilization in meeting the water-based recreation needs in the system. However, increased access may result in a fishing pressure level that could adversely effect the trophy fishery. Consequently, the potential May Lake represents in meeting future recreation needs in the system should be considered quite low.

Lake Level Impact Assessment

May Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha / CHANGE FROM CURRENT BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha / CHANGE FROM CURRENT BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY — ACTIVITY OCCASIONS (x 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (x 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED/POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS / ASSUMPTIONS
+1.0m 100.49	+72 / 385			12.5		5.7	0.7	1.4		20.3	+20.2 / -40.2	80.8	+80.4 / -161.1	NA	
+0.5m 99.99	+36 / 349			11.4		5.2	0.6	1.2		18.4	+18.3 / -42.1	73.2	+72.8 / -168.7	NA	. Shoreline erosion
+0.2m 99.69	+15 / 328	total loss		10.7		4.9	0.6	1.2		17.4	+17.3 / -43.1	69.0	+68.6 / -172.8	NA	. Fishery impacted
Current Mean 94.49 — ESTIMATED EXISTING	313	.62		0.1		⊖	⊖	⊖		0.1		0.4			
Current Mean 94.49 — ESTIMATED POTENTIAL				10.2		4.6	0.6	1.1	44.0	60.5		241.9			
-0.2m 99.29	-15 / 298	+1.56 / 1.98		9.7		4.4	0.5	1.1	140.6	156.3	+156.2 / +95.8	624.9	+624.5 / +383.0	NA	. Fishery impacted
-0.5m 98.99	-43 / 270	+3.32 / 3.94		8.8		4.0	0.5	1.0	272.6	286.9	+286.8 / +226.4	1147.4	+1147.0 / +905.3	NA	
-1.0m 98.49	-71 / 239	+6.43 / 7.05		7.8		3.6	0.4	0.9	500.6	513.3	+513.2 / +452.8	2052.4	+2052.0 / +1810.5	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



SHORELINE AREAS

1. . beach area inundated at 0.2 m increase
   . additional good beach created with decreased water levels

2. . beach area inundated at 0.2 m increase
   . sparse aquatic weed growth exposed with decreased levels

3. . beach area inundated at 0.2 m increase
   . additional beach created with decreased water level - south end of segment, very wide beach created

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan
Western Limited

Scale 1:12,500

May Lake

4.4.4 Tucker Lake

A. Recreation Setting and Existing Use

Tucker Lake is located 40 km northwest of the Town of Cold Lake, just west of Moore Lake. The lake is fed by Jackfish Creek from the north outlet of Bourque Lake. Access to the lake is very poor and has been a major factor limiting the recreation use of the lake. No public or private recreation developments have been constructed at the lake, although there is an informal picnic site and boat launching site on the west shore. There is only one beach which is located on the north central shore. However, at the mean water level, this beach area is inundated. Map 12 locates the high capability shorelines and the existing use areas.

B. Existing Water-Based Recreation Capability

As identified in the Impact Assessment Table (Table 28) the mean water level is 553.74 m which provides approximately 630 ha of usable water surface area and no beach area. The resources at this mean level are capable of sustaining approximately 36 700 water-based activity occasions and a total use - land and water-based - of about 61 700 activity occasions.(16) The estimated annual use of Tucker Lake is 271 activity occasions or less than 1% of the use the resources could support.

Sport fishing appears to be the primary use of the lake, with heavy use during the spring and early summer. Other associated activities such as camping and swimming also occur during this period and during late June and July.

The type of use occurring at the lake would be considered resource oriented. Recreationists view the lake and its shorelands as rustic and primitive, and are attracted to the lake for the sport fishing. Thus, the acceptability of water level alternatives should be assessed primarily in terms of the impacts on the recreation fishing opportunities of the lake.

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(16) These figures represent an estimate of capability based upon the recreation season, area standards, party size, and turnover rates for each activity as discussed in Appendix B.

C. Comparison of Alternative Water Level Fluctuation Implications

A rise in the water level generally results in an increase in the surface area. Because of the relatively steep lake margins and upland bank, only minor increases in the water surface area (3% to 8%) result from the +0.2 m and +0.5 m water levels.

There would be some flooding and shoreline erosion at the northwest and northeast portions of the shoreline, where the lake margin is relatively flat and the backshore zone is lowlying. However, an assessment of the fishery indicated that the added depth would enhance the fisheries and subsequently improve the recreation fishing opportunities of the lake. Furthermore, since the majority of the lake margins and upland banks are composed of sand, the shoreline erosion and deposition processes could create new beach areas.

At water levels greater than +0.5 m, extensive backshore flooding and shoreline erosion would occur in some areas which could cause a deterioration of the water quality and the attractiveness of the lake due to sediment loading and tree fall along these segments of the shoreline. The benefits from an enlarged water surface area would be insignificant compared with the negative impacts of the deterioration in water quality and possible reduction in fisheries.

Any lowering of the water level below the mean would not create benefits to the recreation potential of the lake and could possibly reduce its attractiveness. The -0.2 m water level would expose a narrow margin of aquatic and emergent vegetation in the northeast arm of the lake and would result in an insignificant loss of water surface area. In addition, according to the fisheries assessment, any reduction in the water level would result in a significant loss of spawning areas along the shorelines.

Further water level reductions to -0.5 m expose more shoreline and causes two small islands in the west end of the lake. A decrease to -1.0 m would result in the formation of another small island and reduce the water surface area by 17%. Exposure of weedy shallows would create a deterioration in the visual quality of the lake and a significant loss in fish habitat and spawning areas.

D. Cost Allocation to Recreation with Alternative Water Level Fluctuation

The Summary Rating column on the Impact Assessment table indicates the composite rating for each alternative water level. For Tucker Lake, increases in the water level up to +0.5 m would be acceptable, but any reductions in the water level would not be acceptable. This rating is based primarily upon the recommendations for the fishery since it represents the most significant natural recreation resource. The "Ideal" level would correspond to the fishery assessment and would be at, or slightly above, the +0.2 m water level.

E. Evaluation of Recreation Resource Capability

The +0.2 m and +0.5 m water levels are acceptable water level alternatives. At these levels, the lake has the capability to sustain up to 39 800 water-based recreation activity occasions and 66 800 activity occasions of both water and land-based. Fishing capability accounts for approximately 56% of the total potential water-based capability. Tucker Lake however, is under-utilized with the estimated existing fishing use being only 0.5% of the total fishing capability of the lake. Tucker Lake could potentially sustain up to 200 times its current recreation use level without conflict.

F. Conclusions

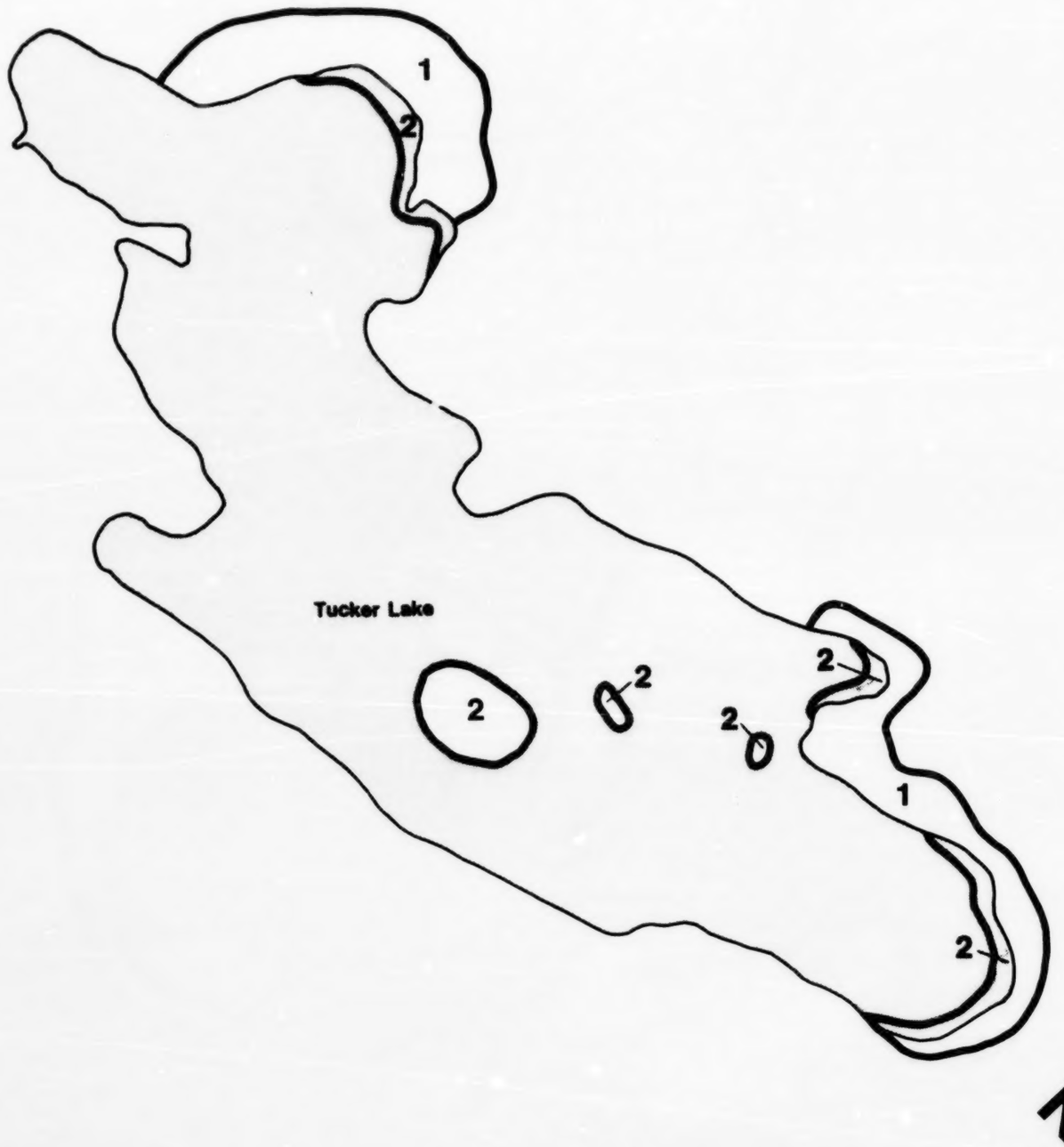
Only increases from the mean water level of +0.2 m and +0.5 m are acceptable from the recreation perspective. These water levels will sustain the existing use levels and patterns, and enhance the fisheries; the key attraction to the lake. The "Ideal" level would be at, or slightly above, the +0.2 m water level. This level, approximately 554.0 m, coincides with the optimum level for the fishery. The lake could sustain considerably more use than the current amount through improved access and the development of recreation facilities such as a boat launch ramp and campground. Tucker Lake could, therefore, absorb a greater proportion of the regional demands for water-based recreation activities.

Lake Level Impact Assessment

Tucker Lake

LAKE LEVELS	PHYSICAL RESOURCES: USABLE WATER SURFACE AREA-ha / CHANGE FROM CURRENT / BALANCE	PHYSICAL RESOURCES: SHORELINE BEACH-ha / CHANGE FROM CURRENT / BALANCE	PUBLIC & COMMERCIAL SHORELINE FACILITIES	WATER SURFACE & SHORELINE ACTIVITY CAPABILITY: ACTIVITY OCCASIONS (x 1000): BOAT FISHING	SAILING	POWER BOATING	CANOEING	WATER SKIING	SWIMMING	ACTIVITY OCCASIONS (x 1000): TOTAL POTENTIAL WATER BASED CAPABILITY	CHANGE FROM ESTIMATED POTENTIAL USE	TOTAL POTENTIAL LAND & WATER BASED CAPABILITY	CHANGE FROM ESTIMATED POTENTIAL USE	SUMMARY RATING (without mitigation)	COMMENTS / ASSUMPTIONS
+1.0m 554.74	+101 / 731			23.7	⊖	13.5	1.6	3.9	⊖	42.7	+28.6 / +3.0	71.7	+71.4 / +10.0	NA	
+0.5m 554.24	+51 / 681			22.1	⊖	12.6	1.5	3.6	⊖	39.8	+39.7 / +3.1	66.8	+66.5 / +1.9	A	. Potential shoreline erosion
+0.2m 553.94	+20 / 650			21.1	⊖	12.0	1.4	3.4	⊖	37.9	+37.8 / +1.2	63.6	+63.3 / +1.9	A	
Current Mean 553.74 — ESTIMATED EXISTING	630			0.1	⊖	⊖	⊖	⊖	⊖	0.1		0.3			IDEAL LEVEL = 554.00
Current Mean 553.74 — ESTIMATED POTENTIAL				20.5	⊖	11.6	1.3	3.3	⊖	36.7		61.7			
-0.2m 553.54	-20 / 610			19.8	⊖	11.3	1.3	3.2	⊖	35.6	+35.5 / -1.1	59.8	+59.5 / -1.9	NA	. Fishery impacted
-0.5m 553.24	-51 / 579			18.8	⊖	10.7	1.2	3.1	⊖	33.8	+33.7 / -2.9	56.8	+56.5 / -4.9	NA	
-1.0m 552.74	-107 / 523			17.0	⊖	9.7	1.1	2.8	⊖	30.6	+30.5 / -6.1	51.4	+51.1 / -10.3	NA	

KEY: OK = NO EFFECT PL = PARTIAL LOSS NU = NOT USABLE



SHORELINE AREAS

1. . no moderate quality beaches
   . extensive flooding of backshore in northwest and northeast shores with 0.5 m increase
2. . wide weedy shoreline margins at 0.2 m decrease

COLD LAKE - BEAVER RIVER

Water-Based Recreation Assessment

PREPARED FOR
Alberta Environment

PREPARED BY
Marshall Macklin Monaghan Western Limited

Scale 1:20,000

Tucker Lake

4.5 Level 3 Lake Assessments

4.5.1 Burnt Lake

A. Recreation Setting and Existing Use

Burnt Lake is a small depressional lake located along the southern boundary of the Primrose Lake Air Weapons Range; approximately 11 km upstream from May Lake on Marie Creek. There are no developed recreation facilities at the lake due to the limited fly-in access and the marshy conditions along most of the shoreline. Any use which may presently occur is unrecorded and probably quite minimal. According to available data, the lake is shallow with extensive areas of low lying shoreline. At the mean water level, about 2 km (21%) of the 9.3 km shoreline consists of sand beach which could support shoreline recreation activities. However, due to the poor upland soil conditions and the presence of emergent vegetation along these shorelines, this beach has a very low recreation capability.

B. Cost Allocation to Recreation with Alternative Water Level Fluctuation

Because of the shallow lake depth and the low lying backshores, even minor changes in the water level will create major changes in the character of the lake and the recreation capability of the shoreline. The historic fluctuation during the recreation season has been used as the basis for the evaluation of the water level alternatives. The mean water level of the lake is 662.43 m. On the west, east and southeast shorelines, an increase to the +0.5 m water level would result in a loss of the majority of the existing beach and extensive flooding of the lowlying backshore areas. The -0.5 m water level along these shorelines would create a 35 m to 70 m wide strip of exposed emergent vegetation which would generally preclude any shoreline recreation activities.

On the remainder of the shoreline (southwest and north), the steep and narrow lake margins and upland banks provide very limited recreation potential. An increase to the +1.0 m water level would eliminate all of the lake margin along these shorelines. Since no site reconnaissance has

been conducted for this lake, there may be small tracts of higher recreation capability which cannot be identified from the level of available data. Any decrease in the water level would result in only a minor loss of the aquatic zone along these shorelines, leaving a narrow strip of exposed emergent vegetation. However, this would have a major impact on the fisheries.

The depth of the lake is sufficient to sustain the usual water surface activities common to the other lakes in the study area. However, the emergent vegetation which grows along all of the shorelands and is beginning to encroach on the main lake body to varying degrees, allows only a low degree of recreation capability.

C. Conclusions

Based upon the shoreline information available and the water levels associated with the alternative fluctuations, the +0.5 m water level would be considered acceptable. This range coincides with the preferred fluctuation for the maintenance of the fishery. The "Ideal" water level would be at, or slightly above, the +0.2 m level. The acceptability of this increase is based upon the very low level of use the area presently experiences, as well as the low attractiveness the lake would present to potential recreationists. Increases above the +0.5 m water level and decreases below the mean water level would result in a total loss of recreation capability and are therefore, not acceptable.

4.5.2 Caribou Lake

A. Recreation Setting and Existing Use

Caribou Lake is a small lake (or slough) located on the Sand River within the Primrose Lake Air Weapons Range. There are no developed facilities on the lake due to the limited fly-in access and poor shoreline which is almost entirely marshy. If any use presently occurs, it is unrecorded. According to available data, the lake is quite shallow with extensive areas of lowlying shoreline. Because the shoreline is so marshy, it is impossible to accurately identify the waters edge. Approximately 3.5 km (25%) of the 13.8 km shoreline consists of sand beach which could support

shoreline recreation activities. However, due to the marshy upland and the dense emergent vegetation along these shorelines, these beaches have a very low recreation capability.

B. Cost Allocation to Recreation with Alternative Water Level Fluctuations

Because Caribou Lake is so shallow, even minor variations in the water level would create major changes in the character of the lake and recreation capability of the shoreline. The mean water level of the lake is 633.25 m. Due to the shallow depth (maximum 2.2 m at the mean water level) of the lake and the extensiveness of the emergent vegetation, the water surface is considered to have little, if any, recreation capability.

From a fishery perspective, any increase in water level would result in an enhanced fishery resource. However, any increase in the fishing potential would have little affect on the low recreation use of the lake because of its remoteness and restricted access.

C. Conclusions

Since the existing historic fluctuations essentially negate the limited recreation capability of the lake, it appears that any additional fluctuation would have little impact on the recreation capability of Caribou Lake. However, any fluctuation that would benefit another resource such as fishing would be acceptable from a recreation perspective. Thus, an increase up to the +1.0 m water level would be the preferred scenario. The "Ideal" level would be that level which provides the optimum fishery, or at about the +0.5 m water level.

4.5.3 Reita Lake

A. Recreation Setting and Existing Use

Reita is a small lake located approximately 40 km southeast of Bonnyville. Drainage occurs via Reita Creek, through Angling Lake to the Beaver River. The lake is extremely shallow (maximum depth of 3 m) and is heavily infested with emergent and submergent vegetation, creating an unattractive lake for traditional water-based activities such as swimming and boating.

There are no developed recreation facilities on the lake due to the poor access and marshy conditions along most of the shoreline, especially the southeast shore. Recreation use of the lake is estimated to be minimal and entirely attributed to waterfowl hunting.

Based upon the analysis of the shoreline conditions, the shoreline would not be able to sustain recreation activities, primarily due to the silt or organic lake bottom in the aquatic and emergent zones, the lowlying backshores and the presence of dense emergent vegetation.

B. Cost Allocation to Recreation with Alternative Water Level Fluctuation

Because of the shallow lake depth and lowlying backshores, even minor changes in the water level would create major changes in the character of the lake and the recreation capability of the shoreline.

Increases to the +0.5 m and +1.0 m water level would extensively flood major portions of the lowlying backshore areas in the west, northeast and southeast arms of the lake. This could result in reduced water quality from increased upland erosion, high nutrient loading from flooded organic backshore areas and vegetation decomposition.

Decreases of any amount would have a major impact on the recreation resources. Wide organic and silt lake margins with dense emergent vegetation would be exposed if the lake level was decreased below the -0.5 m level. This situation would greatly reduce the already insignificant recreation potential. From a fisheries perspective, any decrease in the water level would have a negative impact. Therefore, since this lake receives very little recreation use and has a very low capability to sustain land and water-based activities, the water level could be fluctuated to best meet the needs of other resource uses.

C. Conclusions

Based upon the shoreline information available and the water levels associated with the alternative fluctuations, the +0.2 m water level would be considered acceptable. This range coincides with the preferred fluctuation for the enhancement of the fishery.

The acceptability of this increase is also based upon the very low level of use that this lake currently experiences, as well as the low attractiveness the lake would present to potential recreationists. Water levels above and below the acceptable range result in major loses in the already limited recreation capability of the lake and are therefore, not acceptable.

4.6 Comparison of Existing and Potential Recreation Use Levels

From the previous discussions of water-based recreation at the study lakes, three distinct values for recreation use for each lake have been identified. The existing (1981) use has been estimated from available data sources and from comparable lakes where appropriate. The "Optimum" Recreation Use Intensity Index values have been approximated for each study lake based upon the recreationists' perception of crowding and over use. Finally, the individual lake assessments estimated the recreation capability for each lake using the available resources as the determinant. The purpose of this section is to review these values and compare them to the projected future demand for water-based recreation on the study lakes under the three alternative growth scenarios. Table 29 lists the three recreation values for each lake to assist in this review.

In Growth Scenario One, the baseline increase in water-based recreation demand is estimated without consideration of the heavy oil development. The projected 2 991 000 activity occasions could easily be accommodated within the "optimum" level estimated by the Use Intensity Index.

Growth Scenario Two was based upon a low level of development associated with the heavy oil poject. The projected demand of 3 106 900 activity occasions could also be accommodated within the "optimum" level.

The third growth scenario anticipated a high level of development associated with the heavy oil project. The approximate 4 000 000 activity occasions demanded in this scenario is also within the "optimum" level of recreation use for the total of the study lakes.

It should be recognized that this review is conducted at the system level and no attempt is made to identify which lakes should be developed to what

degree to meet this future demand. When the water management alternatives are identified later in the study process, specific recommendations can be made regarding facility development requirements on certain lakes which would meet the demand.

TABLE 29

COMPARISON OF EXISTING AND POTENTIAL
RECREATION USE LEVELS

(Activity Occasions x 1000)

LAKE	ESTIMATED EXISTING USE	USE INTENSITY - "optimum" level from visitors perceptions	RESOURCE CAPABILITY (@ mean level)
Moose *(1)	973.6	657.8	703.1
Muriel	186.7	710.3	1,562.0
Cold	256.8	2,996.0	5,864.8
Wolf	42.3	373.2	582.6
Ethel	39.9	39.9	150.5
Marie	150.8	299.9	828.7
Angling	8.2	33.2	153.1
Manatokan	29.1	71.9	123.1
May	0.4	21.2 (2)	241.9
Tucker	0.3	58.0 (2)	61.7
TOTAL	1,688.1	5,262.8	10,271.5

* (1) Existing estimated use presently exceeds both the Use Intensity level and the Resource Capability at the mean water level.

(2) Values based on an Intensity Index of 150.

APPENDIX A

1. CAMPER

Questionnaire Analysis

To ascertain the general characteristics of camper use within the study, a brief questionnaire survey was carried out covering 17 of the 21 major public campgrounds.

The camper survey was carried out on June 28 and July 1, 2, 4, 5, and 6, 1981, on ten of the study lakes (Reita, May, Tucker, Burnt, and Caribou were not surveyed) using a systematic sample of campers with a random start using a random numbers table. Each interview was prefaced by an introductory statement explaining that the survey was being conducted by Alberta Environment to find out about the characteristics of recreation use on the study area's lakes. Without exception, the campers responded in a helpful and willing manner, greatly easing the interviewer's task.

The survey revealed that the largest group of visitors came from the Edmonton and immediate area (35%) followed by Regional residents (30%), with neighbouring regions accounting for 20%, the southern part of the province with 11.7%, and out-of-province visitors with only 3.3%.

The length of stay was divided almost evenly between the short stay (1-3 nights) and extended stays (4 nights of more). The high percentage of longer stays supports the finding that the campgrounds served as the main destination area for 83.3% of visitors. There was very little stop-over type of camping (3.3%) and only a modest amount of longer camping tours, 13.4%.

Most people interviewed stated that they visited the area regularly either on an annual basis (36.6%) or 2 or 3 times annually (26.6%), with a considerable number (20%) camping annually in the region more than 3 times a year. 73.3% of those interviewed visited other lakes in the Lakeland Region. This result further reinforced the idea that the area is perceived as a primary destination camping and water-based recreation area.

The study area lakes are primarily visited by families, as evidenced by the fact that 73.2% were in family groups with children. It was commonly observed that 2 or more families composed of either relatives or friends would locate their campsites and vehicles in close proximity to one another, thus demonstrating the strong social character of the camping experience. Couples comprise less than 25% of the groups surveyed.

Not surprisingly, considering the location of the campgrounds on lakes, virtually all of the most important activities engaged in by respondents are water-dependent. The ranking was arrived at by a number of times the activity was marked as the first or second most important activity. For 37.4% of the sample population, fishing was the most important activity, followed by swimming (27.8%), general relaxation (17.4%), water skiing (9.5%) and boating (7.8%).

In many cases, two activities were assigned the same importance because they were the primary activities of different age groups within the interviewer's family, e.g. fishing was the most important activity for parents (especially the fathers), while swimming was equally important for the children. This made the following question somewhat more difficult to analyze (would they still visit if the main opportunity was not available). However, it would appear that the absence of the most favoured activity would cause slightly over half the respondents (51%) to go elsewhere. Of the 49% who would continue to recreate in this area, about half of these stated that they would not frequent the area as often as they had in the past.

This combination of questions underscores the attractiveness of the area's fishing and swimming capability and it would appear that if the capability for these two activities were significantly impaired, the number of visitors would likely decrease rapidly.

It was noteworthy that over 85% of the campers had boats. Only 13.3% of those interviewed didn't own a boat, 11.7% had 2 boats and 75% owned one boat.

There were three major types of boats with runabouts (e.g. car toppers with 20 hp or smaller motors) comprising 46.1%, power boats closely behind

at 38.4%, and canoes 15.5%. There were no rowboat or sailboat owners in the sample and very few such craft were observed to be in use by campers.

There were considerable variations in the perceived levels of use in the campgrounds. The largest group were those who thought conditions were crowded but acceptable (45%), although the next largest group (35%) were those who thought use levels were ideal. This number however, could have been greatly reduced had the survey been conducted solely on weekends when it is generally recognized that many campgrounds are filled to capacity. 20% of the respondents considered the facilities to be overcrowed.

Many visitors had complaints about the recreation area, most of them (63.3%) pertaining to the basic nature of facilities provided and the low level of maintenance and cleanliness. Another common complaint (25%) was the bothersome behaviour of other campers with rowdiness, drunkeness, loud music and vandalism being most often cited. Water quality was not a serious issue with the only complaints coming from some campers in Moose Lake (6.6%). This could be expected to be voiced more often later in the summer when weed and algae growth reach their peak. Poor fishing was also rarely noted as a complaint while over 20% had no complaints at all.

It should be noted that many of the people who complained about the poor facilities and maintenance and anti-social behaviour, mentioned that conditions in the nearby Saskatchewan parks and campgrounds were superior to the Alberta situation. The various facilities were clean and well maintained and the presence of park staff kept unruly behaviour to a minimum.

In terms of winter use, 40% stated that they visited particular lakes in the region. These were largely regional residents and those from nearby communities. The most popular winter activity was ice fishing, carried on by 83.3% of visitors. Cross-country skiing was next with 12.5% of visitors participating and snowmobiling with only 4.2% participating.

More than half of the interviewees (32) had been visiting the area lakes for several years or longer. The question of rememberances of water level

fluctuations was directed at them. Almost 60% could not recall any significant water level differences. This is understandable as lake levels on virtually all the lakes have been reasonably stable in the past. Of the 40% who remembered lake level variations, all mentioned that they thought lake levels had been somewhat lower in the last two years, several even noting that water levels were down anywhere from 6 inches to two and one-half feet. Lakes consistently mentioned as being low were Muriel, Manatokan, Moose and Ethel.

2. COMMERCIAL OPERATOR ANALYSIS

Figure 3, the Commercial Operator's Facilities and Services matrix identifies the operators on the study area lakes. All have lake frontage and are dependent for business on local residents and visitors wishing to enjoy a variety of water-based recreation activities. Seven of the ten businesses surveyed, offered camping and/or roofed accommodation in conjunction with water access such as beaches, boat launch ramps and docking facilities.

All have been in existence for ten years or more with three over 20 years old and one 50 years old. Five of the businesses have been purchased by new operators within the last three to six years. The land holdings vary in size with the marina, restaurant and hotel operation being the smallest (less than 1 acre) and the campground/cabin/boat rental operations the largest, varying from 2.7 to 160 acres in size.

The typical season of operation extends from the Victoria Day weekend in May to the Labour Day weekend in September with a few opening earlier in May or staying open to the end of September. Virtually all business have July and August as the busy season with peaks on the weekends preceeding and following those two months.

The origin of clientele has been a "best estimate" done by the owners as no one keeps a detailed record of the origin of their clientele. The Edmonton area appears to supply by far, the greatest segment of the market for these business (50 to 75%) with Southern Alberta (areas to the south of Highway No. 13) providing the next largest market area (20 - 40%) and

the surrounding region (north of the Yellowhead Highway and east of the Edmonton area) the remainder (10 - 30%). Out-of-province visitors were often mentioned but generally provided only about 10% or less of the clientele.

The owners were divided as to their perceptions of the levels of use of their facilities. Six indicated they thought their operations were under-utilized while the remaining four thought they were receiving optimum use levels. No one mentioned having a situation where they could not keep up with the demand and many operators commented on the peaking problems, with use being very heavy on weekends and light during the week except for four to six weeks in July and August. For five operators, business was increasing, for three others it was regarded as stable while two thought business was declining. Business decline or stagnation were blamed on unfavourable weather, the economic situation (inflation, tight money), the proximity to free government campgrounds, and the increased use of large camping vehicles (thus, less use of cabins). Business growth was attributed largely to the increased number of campers who are city dwellers wishing to escape crowded urban and suburban areas and to the desire to avoid the crowding and rowdiness in government campgrounds.

Two operators (Spring Beach, Kopala Beach Resort) had expansion plans while two others (Pat's Burger Bar, Frank's Marina) had just recently completed growth plans. Two others had plans but could not carry them through because of the high cost of borrowing in one case and inadequate income from a stagnant business in the other case. This latter business was up for sale and another was being sold for retirement reasons. Only one operator had cutback plans and that was merely to discontinue the snack bar post of his business, which was realizing no profit. Two businesses were intending to maintain their existing levels of development.

The major attraction drawing the clientele to the area, according to the commercial operators, was fishing, in association with one or more additional activities. This was mentioned by eight of the operators. Other associated activities were boating, water skiing, swimming and camping. Several campground operators mentioned the quiteness and cleanliness of their facilities when compared with the Transportation

campsites as important features, while four businesses derived a substantial proportion of their income from people in government campgrounds. Good water quality was mentioned as an important factor by businesses on Muriel and Cold Lakes. It appears to about half of the operators that the appeal of the area lakes has been changing during recent years with fishing declining somewhat in importance while boating, water skiing and a general desire to have a change from the city assuming a more significant role.

Virtually every operator acknowledged variations in water level fluctuations stating that lake levels have been noticeably lower during the last two summers. Fortunately, this had no major effect on any of their facilities, although in four instances, the docks and/or launch ramps had to be extended deeper into the water.

BEAVER RIVER - COLD LAKE
RECREATIONAL WATER USER SURVEY

DATE: _____ _____
day month

LOCATION: _____

_____

Weather: 1. sunny hot 3. overcast
2. sunny cool 4. rain

1. Where is your home?

(a) Bonnyville (g) Wainright
(b) Grand Centre (h) Edmonton
(c) Cold Lake (i) Fort Saskatchewan
(d) St. Paul (j) Other Regional _____
(e) Lloydminster (k) Other Alberta _____
(f) Elk Point (l) Out-of-Province _____

2. How long will you stay here on this trip?

day use _____ overnight _____

3. On this trip was this location
(a) your main destination ____
(b) a stop-over on route ____ to where _____
(c) part of a longer touring vacation _____

4. How often do you visit this site each year? _____

5. What other places in this part of the Lakeland do you visit? _____

6. How often? _____

7. What of the following best describes your immediate group?

(a) one person alone ____ (e) one couple only ____
(b) one family with children ___ (f) two or more couples ____
(c) two families with children ___ (g) group of friends ____
(d) three or more families ___ (h) other _____

8. Priorise Activites being engaged in:
(according to time spent)

swimming		water skiing		boating - runabout	
fishing		hiking		- motorboat	
camping		nature study/ photography		- sail	
picnicking				- row	
general sightseeing and relaxation				- canoe/kayak	
				- other	

9. If main opportunity was not available, would you still visit or would you go elsewhere?

Yes _____ No _____

10. According to your perceptions this is

(a) over used (too crowded) _____
(b) acceptable use levels (crowded but okay) _____
(c) ideal use levels (would not want any more) _____
(d) under use (too few people) _____

11. Is there something you do not like about this lake?

(a) fishing is poor ____
(b) poor water quality _____
(c) inadequate facilites, e.g. campsite ____
boat launch ____
marina ____
store ____
(d) low or fluctuating water levels _____
(e) too crowded _____
(f) others, specify _____

_____

12. How many times did you or your family visit this lake last winter?

_____

13. In what activities did you participate?

- ice-fishing _____
- snowmobiling _____
- cross-country skiing _____
- tobogganing _____
- other _____

FOR FREQUENT VISITORS ONLY

14. Do you have any recollection of previous water level fluctuations?

Yes _____ No _____

If so, did it affect your recreational activities?

_____

_____

APPENDIX B

The purpose of this appendix is to present the methodology utilized in the calculation of available resources and associated recreation capability which is listed in the Lake Level Impact Assessment Tables. The specific elements addressed include water level calculation, water surface area calculation, shoreline beach area calculations and the recreation resource capability calculations.

1. Water Levels

Water levels for each lake were provided by Alberta Environment to all study team members. The level which was used as a base from which alternatives were evaluated was the historic mean. The number of years of record used to establish this mean varied between lakes, but it is assumed that sufficient data was available to consider the given mean as representative of the true mean. This mean lake level value is shown in the first column of the table.

2. Water Surface Area

Planimeter calculation tables (PCT) were provided by Alberta Environment for each lake, based upon the most recent bathymetric mapping. The measurement systems (metric and Imperial) varied between lakes, as did the contour intervals. Some bathymetric maps used the lake level the day of the survey as datum, while the majority were based upon a known water surface elevation. The PCT were the only water surface data available for the study lakes.

The general approach for calculating surface area for the alternative levels was to interpolate between the levels given on the PCT for each lake. This involved translating the given data into a change in area (ha) to change in elevation (m) relationship. Where the change in water level from the mean to an alternative level included two or more of the levels measured on the PCT, the proportion of each measured level within that change was calculated individually and summed to produce the actual water surface area.

The calculation of the water surface area associated with alternative water level decreases utilized the available data from the PCT. Since these tables only indicated area for levels below the mean, the water surface areas associated with water level increases were calculated by a linear projection of the highest measurement increment. The water surface change (ha/m) for this highest increment was applied to the alternative water level increases of 0.2, 0.5 and 1.0 m to approximate the water surface area at these higher levels. It is recognized that the slopes of the upland areas are many times quite different than the shoreline or emergent zones, which could produce significantly different area-to-vertical change relationships than those indicated by the highest measured increment on the PCT. However, as PCT's are the only available data, this process was considered the only viable method for determining water surface areas for alternative water level increases. It is felt though, since there is a great diversity in shoreline types found on study lakes, that, on the average, the linear projection of the highest measured increment would reasonably approximate the actual situation.

3. Beach Area

Shoreline resource descriptions provided by Mr. Cam McGregor of Alberta Energy and Natural Resources for each study lake served exclusively as the basis for quantifying and evaluating the beach resources. The shoreline characteristics used in this evaluation included slope, width and surface material(s) of the Lake Margin and Ice Scour zones, and the offshore materials and vegetation in the Emergent and Aquatic I zones. The beach widths given were observed in August 1981 and were converted to their corresponding value at the mean water level prior to evaluation.

a) Beach - The Lake Margin and Ice Scour zones were considered the potential beach zones of the shoreline. The slopes provided in the descriptions were given both individually and in ranges, depending on the characteristics of the shoreline. For the purposes of sunbathing, a maximum slope of 16% was used. Where a slope description included 16% and greater values, the 16% value was used for calculations. The minimum width of a beach was set at 1.0 m which is considered marginally acceptable for shore activities. The surface materials of the ice scour and lake margin considered acceptable were "sand" and "sand with some cobbles".

b) Offshore - The Emergent and Aquatic I zones of each shoreline were evaluated also. The bottom materials on these zones require a composition of a "sand" and "sand and silt" bottom to be considered acceptable. The other characteristic evaluated was the aquatic vegetation. The absence of weeds and algae was preferred, but sparse densities of each was considered acceptable.

4. Recreation Capability

The measure of recreation capability is a synthesis of several recreation use characteristics, including user activity patterns, recreation space/area standards, turnover, party size and the length of the recreation season.

a) Activity Patterns - For each lake, the existing use patterns and preferences were used as a basis for determining recreation resource capability. The percent of total use attributable to each activity was estimated for each study lake in Chapter 2. For the purposes of this study, the activities which utilized the water surface or shoreline were specifically addressed since the alternative water level changes directly effect these resource's capability to provide recreation opportunities. For the water surface, the existing boating use was evaluated. Based upon the consultants' field work and general knowledge of the recreation use of the study area, it was estimated that approximately 75% of the fishing use occurs from boats. The existing use for all boating was summed and the proportion of water surface use attributable to each boating activity was calculated. Further application of these proportions is discussed in paragraph f).

b) Recreation Space/Area Standards - The amount of area required for each activity is a function of two distinct criteria: safety and the type of experience desired. For the boating activities, an area range was established for each activity, with the lower end representing the minimum area required to safely sustain the activity. The determination of the actual area standard to be utilized in the calculation of capability was based upon the type of experience desired by the users of each lake.

Where the primary experience was socially oriented, higher densities are desired and the lower end of the range was utilized. Where the experience is highly resource oriented, lower densities are required and the upper end of the range was used. The area ranges (as well as the turnover and party size) were developed from research done on flat - water-based recreation activities by the United States Bureau of Outdoor Recreation and the U.S. Army Corps. of Engineers. The following table (Table B-1) represents the area standard ranges used in the evaluation of the study lakes:(1)

Table B-1
Area Standards

- Boat Fishing	:	1 boat/2-4 ha of water surface
- Water Skiing	:	1 boat/3-5 ha
- Pleasure Boating	:	1 boat/2-4 ha
- Sailing	:	1 boat/3-4 ha
- Canoeing	:	1 boat/2-5 ha
- Swimming	:	1 swimmer/15 m^2 of beach

c) Turnover - Since each recreation activity may encompass only a few hours per day, each unit of resource is capable of sustaining more than one activity occasion per day. This concept is termed the "turnover" rate and must be applied to each resource to determine it's effective capability. The turnover rates for each water-based activity which were used in calculating capability are listed in Table B-2.

d) Party Size - The number of individuals recreating together, using the same boat, constitutes the party size. This measurement indicates the number of activity occasions possible for each resource unit at any one point in time. The party sizes for each water-based activity which were used in calculating capability are listed in Table B-2.

(1) The following values correspond closely to an overall standard of approximately 4 ha/boat given in the Moose Lake Management Study (page 69).

Table B-2

Recreation Turnover and Party Size Standards

Activity	Turnover	Party Size
Boat Fishing	1.5	2.0
Water Skiing	1.5	2.2
Power Boating	2.0	2.0
Sailing	2.0	1.5
Canoeing	1.5	2.0
Swimming	1.5	1.0

Table B-3

Recreation Area/Space Standards

ACTIVITY / LAKE	Boat Fishing	Water Skiing	Power Boating	Sailing	Canoeing
Moose	2	3	2	3	3
Muriel	3	4	3	4	3
Cold	4	5	4	N/A	N/A
Wolf	5	6	5	N/A	5
Ethel	2	3	3	3	2
Marie	4	5	4	4	5
Angling	2	N/A	3	N/A	3
Manatokan	3	4	4	N/A	4
May	4	6	5	N/A	5
Tucker	4	4	4	4	4

e) Recreation Season - The number of available days in the traditional recreation season of mid-May through the first week of September have been used as the basis for determining the annual recreation use. These are the months when all of the water-based activities are participated in by visitors to the study lakes. It is recognized that use of the lakes does occur during the other months of the year, but generally no information is available as to the amount or type of recreation use that occurs during this period.

The summer recreation season consists of approximately 107 days. This total includes 34 holiday and weekend days and 73 weekdays. The present use of the study lakes is considerably heavier on weekends than week days, with weekdays averaging 30-40% of the weekend use. With trends towards shorter or compressed work weeks, it is anticipated that additional mid-week use would occur in the future, likely approaching approximately 50% of the weekend use. To realistically evaluate the amount of use each lake could support, the anticipated use patterns must be considered.

In this regard, the weekend use is considered full capability and weekday use is considered to be 50% of the weekend use capability. The number of full capability days is therefore 34 days on weekends, plus one half of the 73 week days, or 37 days, which totals 71 season days.

f) All of the water-based recreation activities are evaluated and the total water-based activity occasions are calculated for each activity using the characteristics discussed in paragraphs a) through e). The formula for the application of each of these characteristics is as follows:

$$WSA \times \%WSU \div AS \times TO \times PS \times SD = \text{Activity Occasions}$$

where:

WSA = Water surface area; for each alternative level (ha),
%WSU = proportion of water surface use attributable to the particular boating activity,
AS = area standard (ha),
TO = turnover rate (parties/day),
PS = party size (recreationists/party), and
SD = days in recreation season.

For swimming, the formula uses the amount of beach area available for each alternative level rather than the WSA and %WSU.

Once the total water-based capability (activity occasions), is calculated, the existing proportion of total lake wide use attributable to the water-based activities is identified. Knowing this proportion, the total land and water-based recreation capability can be calculated. These two values - water-based and land and water-based capability in activity occasions - are given in the Assessment Table for each Level 1 and 2 lake. Also shown in this table is a comparison of existing estimated use versus the potential capability of the resources at the mean water level utilizing the methodology discussed above. To quantify the impacts of the alternative water levels on the recreation resource, comparison columns indicate the net gain or loss in capability (measured by activity occasions) at each level for both the existing estimated use and the potential capability at the mean level.